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ABSTRACT

This question book was developed by the Federal Aviation Administration (FAA) for testing applicants who are preparing for certification as airline transport pilots, aircraft dispatchers, or flight navigators. The publication contains several innovative features that are a departure from previous FAA publications related to air carrier personnel certification written tests: (1) testing materials related to the pilot who seeks to advance to the airline transport pilot level are contained in this book, rather than in the previous two separate books; and (2) the test questions are multiple choice, but have three, rather than four, alternative answers, to allow the use of new scoring techniques. The book has been developed to test applicants in the following knowledge areas: air transport pilot-airplane (in two parts), added rating--airplane, helicopter, added rating--helicopter; aircraft dispatcher; and flight navigator. Extensive appendixes provide statistical and background materials needed to answer the questions, including 157 figures. (Answers to the questions are not included, nor are they published by the FAA.) (KC)

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# AIRLINE TRANSPORT PILOT, AIRCRAFT DISPATCHER, AND FLIGHT NAVIGATOR

## QUESTION BOOK

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**Federal Aviation
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# AIRLINE TRANSPORT PILOT, AIRCRAFT DISPATCHER, AND FLIGHT NAVIGATOR

1989

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
Aviation Standards National Field Office

# PREFACE

This question book has been developed by the Federal Aviation Administration (FAA) for testing applicants who are preparing for certification as airline transport pilots, aircraft dispatchers, or flight navigators.

The publication contains several innovative features which are a departure from previous FAA issuances related to air carrier airman certification written tests. These new features are:

1. Testing materials related to the pilot who seeks to advance to the airline transport pilot level are contained in this book. These testing materials are appropriate for testing pilots who have had training or actual experience in flight operations conducted under either FAR Part 121 or FAR Part 135. This feature eliminates the publication of two separate books which contained a significant amount of redundant materials. The combined question book contains test items covering all the written test variations formerly covered in the two books. The airline transport pilot applicant may still request a test related to his or her particular training or experience as related to operations conducted under FAR Part 121 or FAR Part 135.

2. The test questions contained in this publication are all multiple-choice type, a standard practice for all FAA certification written tests. However, the test questions contained in this book have been developed to offer the applicant three alternative answers, rather than the four-answer format used on other FAA written tests. This change has been adopted to allow the use of new scoring analysis techniques.

This question book has been developed to test applicants in the following knowledge areas:

Airline Transport Pilot (FAR Part 121) Airplane
Airline Transport Pilot (FAR Part 135) Airplane
Airline Transport Pilot (FAR Part 135) Added Rating-Airplane
Airline Transport Pilot (FAR Part 135) Helicopter
Airline Transport Pilot (FAR Part 135) Added Rating-Helicopter
Aircraft Dispatcher
Flight Navigator

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Washington, DC 20402

or from U.S. Government Printing Office bookstores located in major cities throughout the United States.

The questions included in this publication are predicated on regulations, principles, and practices that were valid at the time of publication. The question selection sheets prepared for use with this question book are security items and are revised at frequent intervals.

The FAA does NOT publish, supply, or make available the correct answers to questions included in this book. Students should determine the answers by research and study, by working with instructors, or by attending ground schools. The FAA is NOT responsible for either the content of commercial reprints of this book or the accuracy of the answers they may list.

Comments regarding this publication should be directed to:

U.S. Department of Transportation
Federal Aviation Administration
Aviation Standards National Field Office
Examinations Standards Branch
Operations Standards Section, AVN-131
P.O. Box 25082
Oklahoma City, OK 73125

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# GENERAL INSTRUCTIONS

## *MAXIMUM TIME ALLOWED FOR TEST: 6 HOURS*

### TEST MATERIALS

Materials to be used with this question book when used for airman testing:

1. AC Form 8080-3, Airman Written Test Application, which includes the answer sheet.
2. Question selection sheet which identifies the questions to be answered.
3. Plastic overlay sheet which can be placed over performance charts for plotting purposes.

### TAKING THE TEST

1. Read the instructions on page 1 of AC Form 8080-3, and complete page 4 of the form.
2. The question numbers in the question book are numbered consecutively beginning with number 5001. Refer to the question selection sheet to determine which questions to answer.
3. For each item on the answer sheet, find the appropriate question in the question book.
4. Mark your answer in the space provided for that item on the answer sheet.
5. Miscellaneous reference materials are in appendix 2.
6. The supplementary material required to answer the questions will be found in appendix 3.
7. Read each question carefully and avoid hasty assumptions. Do not answer until you understand the question. Do not spend too much time on any one question. Answer all the questions that you readily know and then reconsider those you find difficult. Be careful to make necessary conversions when working with temperatures, speeds, and distances.

If a regulation, chart, or operations procedure is changed after this question book is printed, you will receive credit for the affected question until the next question book revision.

Comments regarding this publication should be directed to:

U.S. Department of Transportation
Federal Aviation Administration
Aviation Standards National Field Office
Examinations Standards Branch
Operations Standards Section, AVN-131
P.O. Box 25082
Oklahoma City, OK 73125

## *THE MINIMUM PASSING GRADE IS 70*

# WARNING

**§ 61.37 Written tests: Cheating or other unauthorized conduct.**

(a) Except as authorized by the Administrator, no person may—

(1) Copy, or intentionally remove, a written test under this part;

(2) Give to another, or receive from another, any part or copy of that test;

(3) Give help on that test to, or receive help on that test from, any person during the period that test is being given;

(4) Take any part of that test in behalf of another person;

(5) Use any material or aid during the period that test is being given; or

(6) Intentionally cause, assist, or participate in any act prohibited by this paragraph.

(b) No person whom the Administrator finds to have committed an act prohibited by paragraph (a) of this section is eligible for any airman or ground instructor certificate or rating, or to take any test therefore, under this chapter for a period of 1 year after the date of that act. In addition, the commission of that act is a basis for suspending or revoking any airman or ground instructor certificate or rating held by that person.

# INTRODUCTION TO THE AIRLINE TRANSPORT PILOT, AIRCRAFT DISPATCHER, AND FLIGHT NAVIGATOR QUESTION BOOK

This question book presents the FAA written tests to the applicants. The book consists of questions on subject areas pertaining to the airline transport pilot, aircraft dispatcher, and flight navigator certificates. This question book is scheduled for revision each 24 months, and associated question selection sheets will be revised periodically as required.

At an FAA testing center or an FAA designated written test examiner's facility, the applicant is issued a "clean copy" of this question book, an appropriate question selection sheet which indicates the specific questions to be answered, and AC Form 8080-3, Airman Written Test Application, which contains the answer sheet. The question book contains all the supplementary material required to answer the questions. This material will be found in appendix 2 and appendix 3.

### *Questions and Scoring*

Answers to questions listed on the question selection sheet should be marked on the answer sheet of AC Form 8080-3. Directions should be read carefully before beginning the test. Incomplete or erroneous personal information entered on this form delays the scoring process. The answer sheet is sent to the Mike Monroney Aeronautical Center in Oklahoma City where it is scored by computer. The applicant will then be issued an AC Form 8080-2, Airman Written Test Report. This report must be presented for a flight test or for retesting in the event of written test failure. The applicant's AC Form 8080-2 will list the subject matter knowledge codes for the knowledge areas in which the applicant is found to be deficient. The written test subject matter knowledge codes, which list these knowledge areas by code, are located in apppendix 1 of this question book.

### *Taking the Test*

The test may be taken at FAA testing centers, FAA written test examiners' facilities, or other designated places. After completing the test, the applicant must surrender the issued question book, question selection sheet, answer sheet, and any papers used for computations or notations, to the monitor before leaving the test room.

When taking the test, the applicant should keep the following points in mind:

1. Answer each question in accordance with the latest regulations and procedures.
2. Read each question carefully before looking at the possible answers. You should clearly understand the problem before attempting to solve it.
3. After formulating an answer, determine which of the alternatives most nearly corresponds with that answer. The answer chosen should completely resolve the problem.
4. From the answers given, it may appear that there is more than one possible answer; however, there is only one answer that is correct and complete. The other answers are either incomplete or are derived from popular misconceptions.
5. If a certain question is difficult for you, it is best to proceed to other questions. After the less difficult questions have been answered, return to those which gave you difficulty. Be sure to indicate on the question selection sheet the questions to which you wish to return.
6. When solving a computer problem, select the answer nearest your solution. The problem has been checked with various types of computers; therefore, if you have solved it correctly, your answer will be closer to the correct answer than to any of the other choices.
7. To aid in scoring, enter personal data in the appropriate spaces on the test answer sheet in a complete and legible manner. Enter the test number printed on the question selection sheet.

### *Retesting—FAR Section 61.49*

Applicants who receive a failing grade may apply for retesting

1. after 30 days from the date the applicant failed the test; or
2. in case of the first failure, the applicant may apply for retesting before the 30 days have expired upon presenting a written statement from an authorized instructor certifying that the instructor has given ground instruction to the applicant and finds the applicant competent to pass the test.

The AC Form 8080-2, Airman Written Test Report, must be presented for the practical test, or for retesting in the event of written test failure.

# QUESTIONS

**5001.** What is an area identified by the term stopway?

1—An area, at least the same width as the runway, capable of supporting an airplane during a normal takeoff.
2—An area designated for use in decelerating an aborted takeoff.
3—An area, not as wide as the runway, capable of supporting an airplane during a normal takeoff.

**5002.** Regulations concerning the operational control of a flight refer to

1—the specific duties of any required crewmember.
2—exercising authority over initiating, conducting, or terminating a flight.
3—exercising the privileges of pilot in command of an aircraft.

**5003.** What is a definition of the term crewmember?

1—Only a pilot, flight engineer, or flight navigator assigned to duty in an aircraft during flight time.
2—A person assigned to perform duty in an aircraft during flight time.
3—Any person assigned to duty in an aircraft during flight except a pilot or flight engineer.

**5004.** What is the name of a plane beyond the end of a runway which does not contain obstructions and can be considered when calculating takeoff performance of turbine-powered aircraft?

1—Clearway.
2—Stopway.
3—Obstruction clearance plane.

**5005.** The minimum steady flight speed or stalling speed in the landing configuration is represented by the symbol

1—$V_S$.
2—$V_{S1}$.
3—$V_{SO}$.

**5006.** Which is the correct symbol for the stalling speed or the minimum steady flight speed at which the airplane is controllable?

1—$V_{SO}$.
2—$V_S$.
3—$V_{S1}$.

**5007.** Which is the correct symbol for design cruising speed?

1—$V_C$.
2—$V_B$.
3—$V_{MA}$.

**5008.** Which speed symbol indicates the maximum operating limit speed for an airplane?

1—$V_{LE}$.
2—$V_{MO}/M_{MO}$.
3—$V_{LO}/M_{LO}$.

**5009.** What is the correct symbol for minimum unstick speed?

1—$V_{MU}$.
2—$V_{MD}$.
3—$V_{FC}$.

**5010.** Which is a definition of $V_2$ speed?

1—Takeoff decision speed.
2—Takeoff safety speed.
3—Minimum takeoff speed.

**5011.** When a temporary replacement is received for an airman's medical certificate, for what maximum time is this document valid?

1—30 days.
2—60 days.
3—90 days.

**5012.** Unless otherwise authorized, the pilot in command is required to hold a type rating when operating any

1—aircraft that is certificated for more than one pilot.
2—aircraft having a gross weight of more than 12,500 pounds.
3—multiengine aircraft having a gross weight of more than 6,000 pounds.

**5013.** The pilot in command is normally required to hold a type rating when operating which of the following?

1—Any turbojet-powered airplane.
2—Any airplane which has a gross weight of 6,000 pounds or more.
3—Any multiengine airplane which is operated under interstate commerce.

**5014.** What is the lowest HAT for which a Category II applicant can be certified during the first 6 months of Category II operations?

1—100 feet AGL.
2—150 feet AGL.
3—200 feet AGL.

**5015.** A Category II ILS pilot authorization, when originally issued, is normally limited to

1—Category II operations not less than 1600 RVR and a 150-foot DH.
2—pilots who have completed an FAA-approved Category II training program.
3—Category II operations not less than 1200 RVR and a 100-foot DH.

**5016.** When may a Category II ILS limitation be removed?

1—When three ILS approaches have been completed to a 150-foot decision height.
2—When six ILS approaches to Category II minimums have been completed in the past 6 months.
3—120 days after issue or renewal.

**5017.** What minimum instrument time in the past 6 months meets the second-in-command requirement to maintain IFR currency in a helicopter?

1—3 hours of actual or simulated time in the same type helicopter.
2—3 hours of actual or simulated IFR in a helicopter.
3—3 hours of actual or simulated IFR in a helicopter and 3 hours in an approved simulator.

**5018.** What minimum conditions are necessary for the instrument approaches required for second in command IFR currency in a helicopter?

1—Three must be made in a helicopter.
2—Three must be made in a rotorcraft category.
3—All may be made in an airplane, helicopter, or approved simulator.

**5019.** Within the past 6 months a pilot has accomplished:

One approach in a helicopter
Two approaches in an airplane
Two approaches in an approved simulator

What additional approaches, if any, must the pilot perform to act as second in command on an IFR helicopter flight?

1—None.
2—One approach in an airplane, helicopter, or approved simulator.
3—Two approaches in a helicopter and one approach in an approved simulator.

**5020.** A pilot, acting as second in command, successfully completes the instrument competency check specified in FAR Part 61. How long does this pilot remain current if no further IFR flights are made?

1—12 months.
2—90 days.
3—6 months.

**5021.** Within the past 6 months a pilot has accomplished:

1 hour actual IFR and 1 hour simulated IFR in a helicopter
2 hours actual IFR in an airplane
1 hour in an approved simulator

What additional instrument time, if any, must that pilot acquire to act as second in command on an IFR helicopter flight?

1—None.
2—1 hour actual or simulated IFR in a helicopter.
3—1 hour actual or simulated IFR in an aircraft.

**5022.** Within the past 6 months a pilot has accomplished:

Two approaches in a helicopter
Two approaches in an airplane
Two approaches in a simulator

What additional approaches, if any, must that pilot perform to act as second in command on an IFR helicopter flight?

1—None.
2—One in a helicopter.
3—One in either a helicopter or an airplane.

**5023.** What instrument flight time may be logged by a second in command of an aircraft requiring two pilots?

1—All of the time the second in command is controlling the airplane solely by reference to flight instruments.
2—One-half the time the flight is on an IFR flight plan.
3—One-half the time the airplane is in actual IFR conditions.

**5024.** What instrument flight time may be logged by the second in command of a two-pilot air taxi flight?

1—All of the time the second in command is controlling the airplane solely by reference to flight instruments.
2—One-half the time the flight is on an IFR flight plan.
3—All of the time the airplane is in actual IFR conditions.

**5025.** To satisfy the minimum required instrument experience for IFR operations, a pilot must accomplish during the past 6 months at least

1—six instrument approaches and 6 hours of instrument time, 3 of the 6 hours in flight in the category of aircraft to be flown.
2—six instrument approaches, three of which must be in the same category and class of aircraft to be flown, and 6 hours of instrument time in any aircraft.
3—six instrument approaches and 6 hours of instrument time in any aircraft.

**5026.** To be eligible for the practical test for the renewal of a Category II authorization, what recent instrument approach experience is required?

1—Within the previous 6 months, six ILS approaches, three of which may be flown to the Category I DH by use of an approach coupler.
2—Within the previous 6 months, six ILS approaches flown by use of an approach coupler to the Category I DH.
3—Within the previous 12 calendar months, three ILS approaches flown by use of an approach coupler to the Category II DH.

**5027.** A flight requiring two pilots is scheduled on August 1. Both the pilot in command and the second in command have First-Class Medical Certificates dated February 28. Prior to the scheduled flight, the pilot in command

1—and second in command must hold certificates appropriate for the flight.
2—must obtain a new First-Class Medical Certificate; the second in command must have a new medical certificate, but a Second-Class Medical Certificate is adequate.
3—must obtain a new First-Class Medical Certificate; the second in command's certificate is adequate.

**5028.** To be eligible for the practical test for the original issue of a Category II authorization, what recent experience is required?

1—Within the previous 6 months, six ILS approaches flown manually to the Category I DH.
2—Within the previous 12 calendar months, six ILS approaches flown by use of an approach coupler to the Category I or Category II DH.
3—Within the previous 6 months, six ILS approaches, three of which may be flown to the Category I DH by use of an approach coupler.

**5029.** What is the minimum number of instrument approaches required to act as pilot in command under IFR conditions?

1—Six in any approved instrument ground trainer or aircraft within the past 6 months.
2—Six, at least three of which must be in an aircraft, within the past 6 months.
3—Six in an aircraft, at least three of which must be in the same category, within the past 6 months.

**5030.** When an airline transport pilot is instructing other pilots in air transportation service, instruction is restricted to

1—those aircraft in which the pilot holds a category, class, and type rating.
2—a maximum of 30 hours in any 7-day period.
3—a school conducted by a certificated air carrier.

**5031.** What restriction is imposed regarding flight instruction of other pilots in air transportation service by an airline transport pilot?

1—30 hours in any 7-day period
2—7 hours in any 1-day period.
3—36 hours in any 7-day period.

**5032.** What maximum hours a day may an airline transport pilot instruct other pilots in air transportation service?

1—6 hours.
2—8 hours.
3—10 hours.

**5033.** A commercial pilot has DC-3 and DC-9 type ratings. A flight test is completed for an Airline Transport Pilot Certificate in a B-727. What pilot privileges may be exercised?

1—ATP—B-727 and DC-3; Commercial—DC-9.
2—ATP—B-727 only; Commercial—DC-9 and DC-3.
3—ATP—B-727 and DC-9; Commercial—DC-3.

**5034.** A commercial pilot has a type rating in a B-727 and B-737. A flight test is completed in a B-747 for the Airline Transport Pilot Certificate. What pilot privileges may be exercised regarding these airplanes?

1—Commercial—B-737; ATP—B-727 and B-747.
2—ATP—B-747; Commercial—B-727 and B-737.
3—ATP—B-747, B-727, and B-737.

**5035.** To serve as flight navigator, a person must possess

1—a current Flight Navigator Certificate only.
2—a current Flight Navigator Certificate and at least a Second-Class Medical Certificate.
3—a current Third-Class Medical Certificate and Airline Transport Pilot Certificate.

**5036.** A Flight Navigator Certificate remains in effect

1—for 2 years.
2—for 12 calendar months.
3—until surrendered, suspended, or revoked.

**5037.** How many hours of satisfactory flight navigation experience must an applicant have logged to apply for a Flight Navigator Certificate if the applicant has no pilot time?

1—100 hours.
2—200 hours.
3—500 hours.

**5038.** How many hours of satisfactory flight navigation experience must an applicant have logged to apply for a Flight Navigator Certificate if the applicant has 500 hours of cross-country flight time as pilot, of which at least 100 hours were at night?

1—100 hours.
2—200 hours.
3—500 hours.

**5039.** If an applicant for a Flight Navigator Certificate fails the flight portion of the practical test, when may the applicant be retested?

1—At the end of a 30-day period or after receiving additional in-flight instruction.
2—After 10 hours of flight instruction.
3—After 5 hours of ground instruction in navigation.

**5040.** What document(s) must be in a person's possession for that person to act as a flight navigator?

1—Current Flight Navigator Certificate and a current Second-Class (or higher) Medical Certificate.
2—Current Flight Navigator Certificate and a valid passport.
3—Third-Class Medical Certificate and current Flight Navigator Certificate.

**5041.** A turbine-engine-powered or large airplane is required to enter an Airport Traffic Area at an altitude of at least

1—1,500 feet AGL.
2—2,000 feet AGL.
3—3,000 feet AGL.

**5042.** What is the maximum indicated airspeed a reciprocating-engine-powered airplane may be operated within a TCA?

1—180 knots.
2—230 knots.
3—250 knots.

**5043.** At what maximum indicated airspeed can a B-727 operate within a TCA without special ATC authorization?

1—230 knots.
2—250 knots.
3—275 knots.

**5044.** At what maximum indicated airspeed may a reciprocating-engine-powered airplane be operated within an Airport Traffic Area?

1—156 knots.
2—180 knots.
3—200 knots.

**5045.** What is the maximum indicated airspeed a turbine-powered aircraft may be operated below 10,000 feet MSL?

1—288 knots.
2—250 knots.
3—230 knots.

**5046.** At what maximum indicated airspeed can a reciprocating-engine airplane operate in the airspace underlying a Terminal Control Area?

1—180 knots.
2—200 knots.
3—230 knots.

**5047.** A pilot of a turbine-powered airplane should climb as rapidly as practicable after taking off to what altitude?

1—1,000 feet AGL.
2—1,500 feet AGL.
3—5,000 feet AGL.

**5048.** What action should a pilot take when a clearance is received from ATC that appears to be contrary to a regulation?

1—Read the clearance back in its entirety.
2—Request a clarification from ATC.
3—Do not accept the clearance.

**5049.** Which facility may be substituted for the middle marker during a Category I ILS approach?

1—VOR/DME FIX.
2—Surveillance radar.
3—Compass locator.

**5050.** When proceeding to the alternate airport, which minimums apply?

1—The IFR alternate minimums section in front of the NOAA IAP book.
2—2000-3 for at least 1 hour before until 1 hour after the ETA.
3—The actual minimums shown on the IAP chart for the airport.

**5051.** The visibility criteria for a particular instrument approach procedure is RVR 40. What minimum ground visibility may be substituted for the RVR value?

1—5/8 SM.
2—3/4 SM.
3—7/8 SM.

**5052.** The prescribed visibility criteria of RVR 32 for the runway of intended operation is not reported. What minimum ground visibility may be used instead of the RVR value?

1—3/8 SM.
2—5/8 SM.
3—3/4 SM.

**5053.** What minimum ground visibility may be used instead of a prescribed visibility criteria of RVR 16 when that RVR value is not reported?

1—1/4 SM.
2—3/4 SM.
3—3/8 SM.

**5054.** While in IFR conditions a pilot experiences two-way radio communications failure, which route should be flown in the absence of an ATC assigned route or a route ATC has advised to expect in a further clearance?

1—The most direct route to the filed alternate airport.
2—An off-airway route to the point of departure.
3—The route filed in the flight plan.

**5055.** What altitude and route should be used if the pilot is flying in IFR weather conditions and has two-way radio communications failure?

1—Continue on the route specified in the clearance and fly the highest of the following: the last assigned altitude, altitude ATC has informed the pilot to expect, or to the MEA.
2—Descend to MEA and, if clear of clouds, proceed to the nearest appropriate airport. If not clear of clouds, maintain the highest of the MEA's along the clearance route.
3—Fly the most direct route to the destination, maintaining the last assigned altitude or MEA, whichever is higher.

**5056.** After experiencing two-way radio communications failure en route, when should a pilot begin the descent for the instrument approach?

1—Upon arrival at any initial approach fix for the instrument approach procedure but not before the flight plan ETA as amended by ATC.
2—Upon arrival at the holding fix depicted on the instrument approach procedure at the corrected ETA, plus or minus 3 minutes.
3—At the primary initial approach fix for the instrument approach procedure at the ETA shown on the flight plan or the EFC time, whichever is later.

**5057.** If a pilot is being radar vectored in IFR conditions and loses radio communications with ATC, what action should be taken?

1—Fly directly to the next point shown on the IFR flight plan and continue the flight.
2—Squawk 7700 and climb to VFR On Top.
3—Fly direct to a fix, route, or airway specified in the vector clearance.

**5058.** A pilot is flying in IFR weather conditions and has two-way radio communications failure. What altitude should be used?

1—Last assigned altitude, altitude ATC has advised to expect, or the MEA, whichever is highest.
2—An altitude that is at least 1,000 feet above the highest obstacle along the route.
3—A VFR altitude that is above the MEA for each leg.

**5059.** A pilot is holding at an initial approach fix after having experienced two-way radio communications failure. When should that pilot begin descent for the instrument approach?

1—At the EFC time, if this is within plus or minus 3 minutes of the flight plan ETA as amended by ATC.
2—At flight plan ETA as amended by ATC.
3—At the EFC time as amended by ATC.

**5060.** Unless otherwise prescribed, what is the rule regarding altitude and course to be maintained by a helicopter during an off-airways IFR flight over non-mountainous terrain?

1—1,000 feet above the highest obstacle within 5 statute miles of course.
2—2,000 feet above the highest obstacle within 5 statute miles of course.
3—1,500 feet above the highest obstacle within a horizontal distance of 3 statute miles of course.

**5061.** Unless otherwise prescribed, what is the rule regarding altitude and course to be maintained by a helicopter during an IFR off-airways flight over mountainous terrain?

1—1,000 feet above the highest obstacle within a horizontal distance of 5 statute miles of course.
2—2,500 feet above the highest obstacle within a horizontal distance of 3 nautical miles of course.
3—2,000 feet above the highest obstacle within 5 statute miles of course.

**5062.** A pilot is operating outside of controlled airspace. If existing weather conditions are below those for VFR flight, an IFR flight plan must be filed and an ATC clearance received prior to

1—takeoff if weather conditions are below IFR minimums.
2—entering controlled airspace.
3—entering IFR weather conditions.

**5063.** What minimum altitude should a helicopter maintain while en route?

1—Over congested areas such as towns, no lower than 1,000 feet over the highest obstacle within a horizontal radius of 2,000 feet of the helicopter.
2—That specifically prescribed by the air carrier for the operation.
3—That prescribed by the Administrator.

**5064.** According to FAR Part 91, when takeoff minimums are not prescribed for a civil airport, what are the takeoff minimums under IFR for a single-engine helicopter?

1—1/2 SM visibility.
2—1 SM visibility.
3—1200 RVR.

**5065.** According to FAR Part 91, when takeoff minimums are not prescribed for a civil airport, what are the takeoff minimums under IFR for a multiengine helicopter?

1—1 SM visibility
2—1/2 SM visibility.
3—1200 RVR.

**5066.** When takeoff minimums are not prescribed for a civil airport, what are the takeoff minimums under IFR for a three-engine airplane?

1—1 SM.
2—1/2 SM.
3—300 feet and 1/2 SM.

**5067.** If being radar vectored to the final approach course of a published instrument approach that specifies "NO PT," the pilot should

1—advise ATC that a procedure turn will not be executed.
2—not execute the procedure turn unless specifically cleared to do so by ATC.
3—execute a holding pattern type procedure turn.

**5068.** When must the pilot initiate a missed approach procedure from an ILS approach?

1—At the DH when the runway is not clearly visible.
2—When the time has expired after reaching the DH and the runway environment is not clearly visible.
3—At the DH, if the visual references for the intended runway are not distinctly visible or anytime thereafter that visual reference is lost.

**5069.** Assuming that all ILS components are operating and the required visual references are not established, the missed approach should be initiated upon

1—arrival at the DH on the glide slope.
2—arrival at the visual descent point.
3—expiration of the time listed on the approach chart for missed approach.

**5070.** What action should be taken when a pilot is "cleared for approach" while being radar vectored on an unpublished route?

1—Descend to minimum vector altitude.
2—Remain at last assigned altitude until established on a published route segment.
3—Descend to initial approach fix altitude.

**5071.** Under which condition may a pilot descend below DH or MDA when using the ALSF-1 approach light system as the necessary visual reference for the intended runway?

1—Under no condition can the approach light system serve as a necessary visual reference for descent below DH or MDA.
2—Descent to the intended runway is authorized as long as any portion of the approach light system can be seen.
3—The approach light system can be used as a visual reference, except that descent below 100 feet above TDZE requires that the red light bars be visible and identifiable.

**5072.** What altitude is a pilot authorized to fly when cleared for an ILS approach? The pilot

1—may begin a descent to the procedure turn altitude.
2—must maintain the last assigned altitude until established on a published route or segment of the approach with published altitudes.
3—may descend from the assigned altitude only when established on the final approach course.

**5073.** While flying IFR in controlled airspace, if one of the two VOR receivers fails, which course of action should the pilot in command follow?

1—No call is required if one of the two VOR receivers is operating properly.
2—Advise ATC immediately.
3—Notify the dispatcher via company frequency.

**5074.** While flying in controlled airspace, the ADF fails. What action is required?

1—Descend below positive control airspace.
2—Advise dispatch via company frequency.
3—Notify ATC immediately.

**5075.** When may ATC request a detailed report on an emergency even though a rule has not been violated?

1—When priority has been given.
2—Anytime an emergency occurs.
3—When the emergency occurs in controlled airspace.

**5076.** What action should be taken if one of the two VHF radios fail while IFR in controlled airspace?

1—Notify ATC immediately.
2—Squawk 7600.
3—Monitor the VOR receiver.

**5077.** What action is necessary when a partial loss of ILS receiver capability occurs while operating in controlled airspace under IFR?

1—Continue as cleared and file a written report to the Administrator if requested.
2—If the aircraft is equipped with other radios suitable for executing an instrument approach, no further action is necessary.
3—Report the malfunction immediately to ATC.

**5078.** During an emergency, a pilot in command does not deviate from a FAR rule but is given priority by ATC. To whom or under what condition is the pilot required to submit a written report?

1—To the manager of the General Aviation District Office.
2—To the manager of the facility in control at the time of the deviation.
3—Upon request by ATC, submit a written report to the ATC manager.

**5079.** A pilot approaching to land a turbine-powered aircraft on a runway served by a VASI shall

1—not use the VASI unless a clearance for a VASI approach is received.
2—use the VASI only when weather conditions are below basic VFR.
3—maintain an altitude at or above the glide slope until a lower altitude is necessary for a safe landing.

**5080.** Which checks and inspections of flight instruments or instrument systems must be accomplished before an aircraft can be flown under IFR?

1—VOR within 30 days and altimeter systems and transponder within 24 calendar months.
2—ELT test within 30 days, altimeter systems within 12 calendar months, and transponder within 24 calendar months.
3—Airspeed indicator within 24 calendar months, altimeter system within 24 calendar months, and transponder within 12 calendar months.

**5081.** Which entry shall be recorded by the person performing a VOR operational check?

1—Frequency, radial and facility used, and bearing error.
2—Flight hours and number of days since last check, and bearing error.
3—Date, place, bearing error, and signature.

**5082.** What is the maximum permissible variation between the two bearing indicators on a dual VOR system when checking one VOR against the other?

1—4° on the ground and in flight.
2—6° on the ground and in flight.
3—6° in flight and 4° on the ground.

**5083.** What record shall be made by the pilot performing a VOR operational check?

1—The date, frequency of VOR or VOT, number of hours flown since last check, and signature in the aircraft log.
2—The date, place, bearing error, and signature in the aircraft log or other record.
3—The date, approval or disapproval, tach reading, and signature in the aircraft log or other permanent record.

**5084.** During a VOT check of the VOR equipment, the course deviation indicator centers on 356° with the TO/FROM reading FROM. This VOR equipment may

1—be used if 4° is entered on a correction card and subtracted from all VOR courses.
2—be used during IFR flights, since the error is within limits.
3—not be used during IFR flights, since the TO/FROM should read TO.

**5085.** If an airborne checkpoint is used to check the VOR system for IFR operations, the maximum bearing error permissible is

1—plus or minus 6°.
2—plus 6° or minus 4°.
3—plus or minus 4°.

**5086.** A function of the minimum equipment list is to indicate required items which

1—are required to be operative for overwater passenger air carrier flights.
2—may be inoperative for a one-time ferry flight of a large airplane to a maintenance base.
3—may be inoperative prior to beginning a flight in a multiengine airplane.

**5087.** When is DME required for an instrument flight?

1—At or above 24,000 feet MSL if VOR navigational equipment is required.
2—In terminal radar service areas.
3—Above 12,500 feet MSL.

**5088.** In what altitude structure is a transponder required when operating in controlled airspace?

1—Above 12,500 feet AGL, excluding the airspace at and below 2,500 feet AGL.
2—Above 12,500 feet MSL, excluding the airspace at and below 2,500 feet AGL.
3—Above 14,500 feet MSL, excluding the airspace at and below 2,500 feet AGL.

**5089.** Which of the following is a transponder requirement for helicopter operations?

1—Helicopters with a certified gross weight of more than 12,500 pounds that are engaged in commercial operations are required to be equipped with operable ATC transponders.
2—Under the terms of a letter of agreement, helicopters may be operated at or below 1,000 feet AGL within TCA's without an operable ATC transponder.
3—Operable ATC transponders are required when operating helicopters within control zones at night under special VFR.

**5090.** In addition to a two-way radio capable of communicating with ATC on appropriate frequencies, which equipment is the helicopter required to have to operate within a Terminal Control Area? (Letter of agreement not applicable.)

1—A VOR or TACAN receiver.
2—DME, a VOR or TACAN receiver, and an appropriate transponder beacon.
3—An appropriate radar beacon transponder.

**5091.** In addition to the localizer, glide slope, marker beacons, approach lighting, and HIRL, which ground components are required to be operative for a Category II instrument approach to a DH below 150 feet AGL?

1—RCLS and REIL.
2—Radar and RVR.
3—TDZL, RCLS, and RVR.

**5092.** When may a pilot descend below 100 feet above the touchdown zone elevation during a Category II ILS instrument approach when only the approach lights are visible?

1—After passing the visual descent point (VDP).
2—When the RVR is 1,600 feet or more.
3—When the red terminal bar of the approach light systems are in sight.

**5093.** Which ground components are required to be operative for a Category II approach in addition to LOC, glide slope, marker beacons, and approach lights?

1—Radar and RVR.
2—RCLS and REIL.
3—HIRL, TDZL, RCLS, and RVR.

**5094.** Information obtained from flight data and cockpit voice recorders shall be used only for

1—determining who was responsible for any accident or incident.
2—determining evidence for use in civil penalty or certificate action.
3—determining possible causes of accidents or incidents.

**5095.** For what purpose may cockpit voice recorders and flight data recorders not be used?

1—Determining causes of accidents and occurrences under investigation by the NTSB.
2—Determining any certificate action, or civil penalty, arising out of an accident or occurrence.
3—Identifying procedures that may have been conducive to any accident, or occurrence resulting in investigation under NTSB Part 830.

**5096.** How long is cockpit voice recorder and flight recorder data kept, in the event of an accident or occurrence resulting in terminating the flight?

1—60 days.
2—90 days.
3—30 days.

**5097.** A commercial operator plans to ferry a large, four-engine, reciprocating-engine-powered airplane from one facility to another to repair an inoperative engine. Which is an operational requirement for the three-engine flight?

1—The gross weight at takeoff may not exceed 75 percent of the maximum certificated gross weight.
2—Weather conditions at the takeoff and destination airports must be VFR.
3—The computed takeoff distance to reach $V_1$ must not exceed 70 percent of the effective runway length.

**5098.** Which operational requirement must be observed when ferrying an air carrier airplane when one of its three turbine engines is inoperative?

1—The weather conditions at takeoff and destination must be VFR.
2—The flight cannot be conducted between official sunset and official sunrise.
3—Weather conditions must exceed the basic VFR minimums for the entire route, including takeoff and landing.

**5099.** Which operational requirement must be observed when ferrying a large, turbine-engine-powered airplane when one of its engines is inoperative?

1—The weather conditions at takeoff and destination must be VFR.
2—Weather conditions must exceed the basic VFR minimums for the entire route, including takeoff and landing.
3—The flight cannot be conducted between official sunset and sunrise.

**5100.** When a turbine-engine-powered airplane is to be ferried to another base for repair of an inoperative engine, which operational requirement must be observed.

1—Only the required flight crewmembers may be on board the airplane.
2—The existing and forecast weather for departure, en route, and approach must be VFR.
3—No passengers except authorized maintenance personnel can be carried.

**5101.** Which operational requirement must be observed by a commercial operator when ferrying a large, three-engine, turbojet-powered airplane from one facility to another to repair an inoperative engine?

1—The computed takeoff distance to reach $V_1$ must not exceed 70 percent of the effective runway length.
2—The existing and forecast weather for departure, en route, and approach must be VFR.
3—No passengers can be carried.

**5102.** A person may not act as a crewmember of a civil aircraft if alcoholic beverages have been consumed by that person within the preceding

1—8 hours.
2—12 hours.
3—24 hours.

**5103.** How may an aircraft operate in North Atlantic (NAT) Minimum Navigation Performance Specifications Airspace with less than the minimum navigation capability required by FAR Part 91, appendix C? By

1—operating under VFR conditions only.
2—requesting a deviation from the Administrator.
3—operating only between 2400Z and 0600Z.

**5104.** Which publication includes information on operations in the North Atlantic (NAT) Minimum Navigation Performance Specifications Airspace?

1—FAR Part 121.
2—ICAO Annex 1, Chapter 2.
3—FAR Part 91.

**5105.** When a certificate holder is notified that a person specifically authorized to carry a deadly weapon is to be aboard an aircraft (except in an emergency), how long before loading that flight should the air carrier be notified?

1—5 hours.
2—2 hours.
3—1 hour.

**5106.** When a person, in the custody of law enforcement personnel, is scheduled on a flight, what procedures are required regarding boarding of this person and the escort?

1—They shall enplane and depart before all other passengers.
2—They shall be boarded after all other passengers enplane, and deplaned before all other passengers deplane.
3—They shall be boarded before all other passengers enplane, and deplaned after all passengers have left the aircraft.

**5107.** When a passenger notifies the certificate holder prior to checking baggage that an unloaded weapon is in the baggage, what action is required by regulation regarding this baggage?

1—The baggage may be carried in the flightcrew compartment, provided the baggage remains locked.
2—The baggage must remain locked and only the passenger retains the key.
3—The baggage must remain locked and custody of the key shall remain with a designated person other than the owner of the weapon.

**5108.** Which applies to the carriage of a person in the custody of law enforcement personnel?

1—The air carrier is not allowed to serve a meal to the person in custody.
2—No more than one person in custody may be carried on a flight if the person is considered to be in a maximum risk category.
3—The person in custody and the escort must remain seated for the entire flight.

**5109.** With whom must the crew of a domestic and flag air carrier airplane be able to communicate, under normal conditions, along the entire route of flight.

1—Any FSS.
2—ARINC
3—Company dispatch office.

**5110.** With whom must the crew of a domestic and flag air carrier airplane be able to communicate, under normal conditions, along the entire route of flight?

1—Any FSS.
2—ARINC
3—Air Traffic Control.

**5111.** For which of these aircraft is the "clearway" for a particular runway considered in computing takeoff weight limitations?

1—Passenger-carrying transport aircraft.
2—U.S. certified air carrier airplanes.
3—Turbine-engine-powered transport airplanes.

**5112.** What effective runway length is required for a turbojet-powered airplane at the destination airport if the runways are forecast to be wet or slippery at the ETA?

1—70 percent of the actual runway available.
2—150 percent of the runway length required for a dry runway.
3—115 percent of the runway length required for a dry runway.

**5113.** What restrictions must be observed regarding the carrying of cargo in the passenger compartment of an airplane operated under FAR Part 121?

1—All cargo must be separated from all seated passengers by a partition capable of withstanding certain load stresses.
2—Cargo may be carried aft of a divider if properly secured by a safety belt.
3—All cargo must be carried in a suitable bin and secured to the floor structure of the airplane.

**5114.** What requirement must be met regarding cargo that is carried anywhere in the passenger compartment of an air carrier airplane.

1—The bin in which the cargo is carried may not be installed in a position that restricts access to, or use of, any emergency exit.
2—Cargo may not be carried anywhere in the rear of the passenger compartment.
3—The container or bin in which the cargo is carried must be made of material which is at least flash resistant.

**5115.** Information recorded during normal operation by a required cockpit voice recorder in a passenger-carrying airplane

1—must be retained for 30 minutes after landing.
2—may be erased only once each flight.
3—may all be erased except the last 30 minutes.

**5116.** Which rule applies to the use of the cockpit voice recorder erasure feature?

1—All recorded information may be erased at the end of a flight.
2—Any information more than 30 minutes old may be erased.
3—Any ground operation that was recorded may be erased.

**5117.** For the purpose of testing the flight recorder system,

1—a maximum of 45 minutes of the oldest prerecorded data may be erased.
2—a total of 1 hour of the oldest recorded data accumulated at the time of testing may be erased.
3—a total of no more than 1 hour of recorded data may be erased.

**5118.** When must a cockpit voice recorder be operated?

1—From the start of the before starting engine checklist to completion of checklist prior to engine shutdown.
2—From the start of the before starting engine checklist to completion of final checklist upon termination of flight.
3—When starting to taxi for takeoff to engine shutdown after termination of flight.

**5119.** If there is a required emergency exit located in the flightcrew compartment, the door which separates the compartment from the passenger cabin must

1—be locked at all times, except during emergencies, while landing.
2—be locked at all times, except during any emergency declared by the pilot in command.
3—be latched open during takeoff and landing.

**5120.** If a passenger-carrying landplane is required to have an automatic deploying escape slide system, when must this system be armed?

1—During taxi, takeoff, and landing.
2—Only for takeoff and landing.
3—Only for taxi and takeoff.

**5121.** If a turbine-engine-powered, pressurized airplane is not equipped with quick-donning oxygen masks, what is the maximum flight altitude authorized without one pilot wearing and using an oxygen mask?

1—FL300.
2—FL250.
3—FL200.

**5122.** If either pilot of an air carrier airplane leaves the duty station while flying at FL310, the other pilot

1—shall put on and use an oxygen mask.
2—must have a quick-donning type oxygen mask available.
3—and the flight engineer shall put on and use their oxygen mask.

**5123.** Which airplanes are required to be equipped with a ground proximity warning glide slope deviation alerting system?

1—All turbojet-powered airplanes.
2—Passenger-carrying airplanes only.
3—Large turbine-powered airplanes only.

**5124.** When may two persons share one seatbelt in a lounge seat?

1—When one is an adult and one is a child under 3 years of age.
2—Only during the en route portion of a flight.
3—During all operations except the landing portion of a flight.

**5125.** While on an IFR flight in controlled airspace, the failure of which unit will precipitate an immediate report to ATC?

1—Secondary or backup attitude indicator.
2—Airborne radar altimeter.
3—DME.

**5126.** An air carrier airplane's airborne radar must be in satisfactory operating condition prior to dispatch, if the flight will be

1—conducted under IFR conditions and thunderstorms are reported en route.
2—carrying passengers, but not if it is "all cargo."
3—conducted over water more than 50 miles from shore.

**5127.** If an air carrier airplane's airborne radar is inoperative and thunderstorms are forecast along the proposed route of flight, an airplane may be dispatched only

1—when two alternate airports are filed.
2—if the flight is filed IFR.
3—in day VFR conditions.

**5128.** If an air carrier airplane is flying IFR using a single ADF navigation receiver and the ADF equipment fails, the flight must be able to

1—proceed safely to a suitable airport using VOR aids and complete an instrument approach.
2—continue to the destination airport by means of dead reckoning navigation.
3—proceed to and land at a filed en route alternate airport.

**5129.** What action should be taken by the pilot in command of a transport category airplane if the airborne weather radar becomes inoperative en route on an IFR flight for which weather reports indicate possible thunderstorms?

1—Request radar vectors from ATC to the nearest airport suitable for large aircraft landings.
2—Proceed in accordance with the approved instructions in the operations manual.
3—Return to the departure airport if closer than the destination airport.

**5130.** When a pilot plans a flight using NDB NAVAIDS, which rule applies?

1—An alternate airport must be filed that has a radar approach available.
2—The pilot must be able to return to the departure airport using other navigation radios.
3—The airplane must have sufficient fuel to proceed, by means of VOR NAVAIDS, to a suitable airport and land.

**5131.** When must an air carrier airplane be DME equipped?

1—Whenever VOR navigational receivers are required.
2—For flights at or above 18,000 feet MSL.
3—In the Continental Control Area for all IFR or VFR On Top operations.

**5132.** When an air carrier flight is operated under IFR or over-the-top on "victor airways," which navigation equipment is required to be installed in duplicate?

1—ADF.
2—VOR.
3—Marker beacon receiver.

**5133.** The emergency lights on a passenger-carrying airplane must be armed or turned on during

1—preflight prior to night operations.
2—taxiing, takeoff, and landing.
3—preflight prior to every flight.

**5134.** Federal Aviation Regulations require that interior emergency lights must

1—operate automatically when subjected to a negative G load.
2—be operable manually from the flightcrew station and the passenger compartment.
3—be armed or turned on during ground operation and all flight operations.

**5135.** Where should the portable battery-powered megaphone be located if only one is required on a passenger-carrying airplane?

1—The most rearward location in the passenger cabin.
2—The most forward location in the passenger cabin.
3—In the passenger cabin near the overwing emergency exit.

**5136.** How many portable battery-powered megaphones are required on an air carrier airplane with a seating capacity of 100 passengers on a trip segment when 45 passengers are carried?

1—Two; one at the forward end and the other at the most rearward location in the passenger cabin.
2—One; at the most rearward location in the passenger cabin.
3—Two; one located near or accessible to the flightcrew and one located near the center of the passenger cabin.

**5137.** How many portable battery-powered megaphones are required on an air carrier airplane with a seating capacity of 150 passengers on a trip segment when 75 passengers are carried?

1—Two; one located near or accessible to the flightcrew, and one located near the center of the passenger cabin.
2—One; at the most rearward location in the passenger cabin.
3—Two; one at the forward end, and the other at the most rearward location of the passenger cabin.

**5138.** In the event of an engine emergency, the use of a cockpit check procedure by the flightcrew is

1—discouraged because of possible failure of the cockpit lighting system.
2—required by regulations to prevent reliance upon memorized procedures.
3—recommended by the FAA as a doublecheck after the memorized procedure has been followed.

**5139.** Which emergency equipment is required for a flag air carrier flight between John F. Kennedy International Airport and London, England?

1—A life preserver or other flotation device for the full seating capacity of the airplane.
2—An appropriately equipped survival kit attached to each required liferaft.
3—A self-buoyant, water resistant, portable radio for each required liferaft.

**5140.** What emergency equipment is required for extended overwater operations?

1—A portable emergency radio transmitter for each crewmember.
2—A survival kit for each life preserver.
3—A life preserver equipped with a survivor locator light, for each occupant.

**5141.** Each large aircraft operating over water must have a life preserver for each

1—seat on the aircraft.
2—occupant.
3—seat, plus 10 percent

**5142.** For a flight over uninhabited terrain, an airplane operated by a flag or supplemental air carrier must carry enough appropriately equipped survival kits for

1—50 percent of the passengers.
2—all occupants of the airplane.
3—all paying passengers.

**5143.** When a supplemental air carrier is operating over an uninhabited area, how many appropriately equipped survival kits are required aboard the airplane?

1—One for each passenger seat.
2—One for each four passengers.
3—Enough for the number of occupants of the airplane.

**5144.** Life preservers required for overwater operations are stored

1—adjacent to every emergency exit.
2—behind the cockpit bulkhead.
3—within easy access in the event of ditching.

**5145.** An airplane operated by a supplemental air carrier flying over uninhabited terrain must carry which emergency equipment?

1—Survival saw.
2—Pyrotechnic signaling device.
3—Colored smoke flares.

**5146.** An airplane operated by a commercial operator flying over uninhabited terrain must carry which emergency equipment?

1—Colored smoke flares.
2—Pyrotechnic signaling device.
3—Survival saw.

**5147.** An airplane operated by a flag air carrier operator flying over uninhabited terrain must carry which emergency equipment?

1—Pyrotechnic signaling device.
2—Colored smoke flares.
3—Survival saw.

**5148.** An air carrier airplane must have an operating public address system if it

1—has 15 or more passengers aboard.
2—has a seating capacity for more than 19 passengers.
3—weighs more than 12,500 pounds.

**5149.** A crewmember interphone system is required on which airplane?

1—A large airplane.
2—An airplane with more than 19 passenger seats.
3—A turbojet airplane.

**5150.** Which requirement applies to emergency equipment (fire extinguishers, megaphones, first aid kits, and crash ax) installed in an air carrier airplane?

1—Cannot be located on the flight deck, all must be located in the passenger compartment.
2—Cannot be located in a compartment or area where it is not immediately visible to a flight attendant in the passenger compartment.
3—Must be clearly marked to indicate its method of operation.

**5151.** Which factor determines the minimum number of hand fire extinguishers required for flight under FAR Part 121?

1—Number of passengers aboard.
2—Number of required crewmembers.
3—Number of passenger seats in the airplane.

**5152.** Which restriction applies to a cargo bin in a passenger compartment? The bin

1—may have an open top if the cargo is secured by a cargo net.
2—must withstand the load factor required of passenger seats, multiplied by 1.15.
3—must be equipped with an approved fire-extinguishing system and constructed of flame retardant material.

**5153.** What is the passenger oxygen supply requirement for a flight with a cabin pressure altitude in excess of 15,000 feet? Enough oxygen for

1—all passengers for the entire flight duration above 15,000 feet cabin altitude.
2—50 percent of the actual passenger load for 30 minutes.
3—10 percent of the seating capacity at those altitudes.

**5154.** How much supplemental oxygen must pressurized air transport airplanes carry for each flight crewmember on flight deck duty when operating at flight altitudes of 10,000 feet?

1—A minimum of 2-hours' supply.
2—Sufficient for the duration of the flight above 8,000 feet cabin pressure altitude.
3—Sufficient for the duration of the flight above 10,000 feet flight altitude.

**5155.** What is the highest flight level that operations may be conducted without the pilot at the controls wearing and using an oxygen mask while the other pilot is away from the duty station?

1—FL410.
2—FL310.
3—FL250.

**5156.** Above which cabin altitude must oxygen be provided for all passengers during the entire flight?

1—15,000 feet.
2—12,000 feet.
3—14,000 feet.

**5157.** For a 2-hour flight in a turbine-engine-powered airplane at a cabin pressure altitude of 12,000 feet, how much supplemental oxygen for sustenance must be provided? Enough oxygen for

1—10 percent of the passengers for 1.5 hours.
2—each passenger during the entire flight.
3—each passenger for 30 minutes.

**5158.** A flight crewmember must be able to don and use a quick-donning oxygen mask within

1—5 seconds.
2—15 seconds.
3—20 seconds.

**5159.** Each air carrier flight deck crewmember on flight deck duty must be provided with an oxygen mask that can be rapidly placed on his face when operating at flight altitudes above

1—FL200.
2—FL250.
3—FL120.

**5160.** The supplemental oxygen requirements for passengers when a flight is operated at or below FL250 is dependent upon the airplane's ability to make an emergency descent to a flight altitude of

1—10,000 feet within 4 minutes.
2—12,000 feet within 4 minutes or at a minimum rate of 2,500 feet per minute, whichever is quicker.
3—14,000 feet within 4 minutes.

**5161.** A passenger briefing by a crewmember shall be given, instructing passengers on the necessity and use of oxygen in the event of cabin depressurization prior to flights conducted above

1—FL250.
2—FL240.
3—FL200.

**5162.** What is the minimum number of acceptable oxygen-dispensing units for first aid treatment of occupants who might require undiluted oxygen for physiological reasons?

1—Four.
2—Three.
3—Two.

**5163.** Routes that require a flight navigator are listed in the

1—Airplane Flight Manual.
2—International Flight Information Manual.
3—Air Carrier's Operations Specifications.

**5164.** Where is a list maintained for routes that require special navigation equipment?

1—Air Carrier's Operations Specifications.
2—International Flight Information Manual.
3—Airplane Flight Manual.

**5165.** Which document includes descriptions of required crewmember functions to be performed in the event of an emergency?

1—Airplane Flight Manual.
2—Certificate holder's manual.
3—Emergency Procedures Handbook.

**5166.** A flight navigator or a specialized means of navigation is required aboard an air carrier airplane operated outside the 48 contiguous states and District of Columbia when

1—the airplane's position cannot be reliably fixed for a period of more than 1 hour.
2—operations are conducted IFR or VFR On Top.
3—operations are conducted over water more than 50 miles from shore.

**5167.** Required crewmember functions to be performed in the event of an emergency shall be assigned by the

1—pilot in command.
2—air carrier's chief pilot.
3—certificate holder.

**5168.** What is the minimum number of flight attendants required for an airplane having a seating capacity of 176 passengers with only 113 passengers aboard.

1—Five.
2—Four.
3—Three.

**5169.** What is the minimum number of flight attendants required for an air carrier airplane with a seating capacity for 335 passengers when 299 passengers are aboard?

1—Seven.
2—Six.
3—Five.

**5170.** An air carrier that elects to use an Inertial Navigational System (INS) must meet which equipment requirement prior to takeoff on a proposed flight?

1—One INS with a dual VORTAC/ILS system may be used as a backup.
2—Dual ILS systems with an operative Flight Director System may be used as a backup for one inoperative INS.
3—One INS may be inoperative, but an operational Doppler Radar unit may be substituted in its stead.

**5171.** If a turbojet air carrier flight is to be operated in VFR over-the-top conditions, which radio navigation equipment is required to be a dual installation?

1—VOR and ILS.
2—VOR.
3—VOR and DME.

**5172.** Which equipment requirement must be met by an air carrier that uses an Inertial Navigation System (INS) on a proposed flight?

1—Dual ILS systems with an operative Flight Director System can be substituted for one inoperative INS.
2—A dual VORTAC/ILS system may be substituted for an inoperative INS.
3—Only one INS is required if an operative Doppler Radar can be substituted for the other INS.

**5173.** When an air carrier airplane with a seating capacity of 187 has 151 passengers on board, what is the minimum number of flight attendants required?

1—Five.
2—Four.
3—Three.

**5174.** An airplane has a seating capacity of 149 passengers. What is the minimum number of flight attendants required with 97 passengers aboard

1—Four.
2—Three.
3—Two.

**5175.** The "age 60 rule" of FAR Part 121 applies to

1—any required pilot crewmember.
2—any pilot or flight engineer.
3—the pilot in command only.

**5176.** When the need for a flight engineer is determined by aircraft weight, what is the takeoff weight above which a flight engineer is required?

1—80,000 pounds.
2—12,500 pounds.
3—300,000 pounds.

**5177.** Under which condition is a flight engineer required as a flight crewmember in FAR Part 121 operations?

1—If the airplane has a seating capacity for 30 passengers or more.
2—If the airplane is powered by more than two engines.
3—If required by the airplane's type certificate.

**5178.** If a flight engineer becomes incapacitated during flight, who may perform the flight engineer's duties?

1—The second in command only.
2—Any crewmember designated by the pilot in command.
3—Either pilot, if qualified to perform flight engineer functions.

**5179.** On an air carrier airplane that is certified for operation with a flightcrew of two pilots and one flight engineer, in case of emergency,

1—at least one pilot must be qualified to perform flight engineer duties.
2—the flight engineer must be qualified to perform duties at one pilot position.
3—each pilot must be qualified to perform flight engineer duties.

**5180.** When a flight engineer is a required crewmember on a flight, it is necessary for

1—at least one pilot to hold a Flight Engineer Certificate.
2—the flight engineer to be properly certificated and qualified, but there is no requirement for any other crewmember to be qualified or certified to perform flight engineer duties.
3—at least one pilot to be qualified to perform flight engineer duties, but a certificate is not required.

**5181.** If a flight crewmember completes a required annual flight check in December 1987 and the required annual recurrent flight check in January 1989, the latter check is considered to have been taken in

1—December.
2—January
3—November.

**5182.** What is the term for the training required for flight crewmembers who have not qualified and served in the same capacity on another airplane of the same group (e.g., turbojet powered)?

1—Upgrade training.
2—Primary training.
3—Initial training.

**5183.** A crewmember who has served as second in command on a particular type airplane (e.g., B-727-100), may serve as pilot in command upon completing which training program?

1—Upgrade training.
2—Recurrent training.
3—Initial training.

**5184.** What is the term for the training required for crewmembers or dispatchers who have qualified and served in the same capacity on other airplanes of the same group?

1—Difference training.
2—Transition training.
3—Upgrade training.

**5185.** How often must a crewmember actually operate the airplane emergency equipment? Once every

1—6 calendar months.
2—12 calendar months.
3—24 calendar months.

**5186.** The air carrier must give instruction on such subjects as respiration, hypoxia, and decompression to each crewmember serving on pressurized airplanes operated above

1—20,000 feet.
2—12,000 feet.
3—25,000 feet.

**5187.** A pilot in command must complete either a proficiency check or simulator training within the preceding

1—6 months.
2—12 months.
3—24 months.

**5188.** Any person whose duties include the handling or carriage of dangerous articles and magnetized materials must have satisfactorily completed an established and approved training program within the preceding

1—24 calendar months.
2—12 calendar months.
3—6 calendar months.

**5189.** A pilot flight crewmember, other than pilot in command, must have received either a proficiency check or line-oriented simulator training within the preceding

1—6 months.
2—12 months.
3—24 months.

**5190.** Which is one of the requirements that must be met by a required pilot flight crewmember in re-establishing recency of experience?

1—At least one landing must be made to a full stop with a simulated failure of the most critical engine.
2—At least one landing must be made from an ILS approach to the lowest ILS minimums authorized for the certificate holder.
3—At least two landings must be made to a complete stop.

**5191.** What is one of the requirements that must be met by an airline pilot to re-establish recency of experience?

1—At least one landing approach must be made from a circling instrument approach.
2—At least one landing must be made to a full stop.
3—At least one nonprecision approach must be made to the lowest minimums authorized for the certificate holder.

**5192.** What are the line check requirements for the pilot in command for a domestic air carrier?

1—The line check is required only when the pilot is scheduled to fly a new route.
2—The line check is required each 12 calendar months in one of the types of airplanes to be flown.
3—The line check is required each 12 months in each type aircraft in which the pilot may serve.

**5193.** Normally, a dispatcher should be scheduled for no more than

1—6 consecutive hours of service in any 24 hours.
2—8 hours of service in any 24 consecutive hours.
3—10 hours of service in any 24 consecutive hours.

**5194.** An aircraft dispatcher shall receive at least 24 consecutive hours of rest during each

1—120 consecutive hours.
2—7 consecutive days.
3—10 consecutive days.

**5195.** To remain current as an aircraft dispatcher, a person must, in addition to other requirements,

1—make a trip over one of the air carrier's routes within the preceding 6 calendar months.
2—spend 5 hours observing flight deck operations within the preceding 12 calendar months.
3—make a trip in one of the types of airplanes to be dispatched, every 3 calendar months.

**5196.** If a domestic or flag air carrier schedules a dispatcher for 13 hours of duty in a 24-consecutive-hour period, what action is required?

1—The dispatcher should report a violation of FAR Part 121 to the air carrier's director of operations.
2—Within 72 hours, the dispatcher should report a violation of FAR Part 121 to the supervising air carrier district office.
3—The dispatcher should be given a rest period of at least 8 hours at or before the completion of 10 hours of duty.

**5197.** Duty and rest period rules for domestic air carrier operations require that a flight crewmember

1—not be assigned to any duty with the air carrier during a required rest period.
2—not be on duty aloft for more than 90 hours in any calendar month.
3—be relieved of all duty for at least 48 hours during any 7 consecutive days.

**5198.** When a flag air carrier airplane requires more than one flight engineer or flight navigator, which flight time limitation applies during any 12 calendar months?

1—1,000 hours.
2—1,100 hours.
2—1,200 hours.

**5199.** What is the maximum number of hours that a pilot may fly as a crewmember in domestic air carrier service?

1—120 hours in any 30 consecutive days and 1,200 hours in any 12 consecutive months.
2—120 hours in any calendar month and 1,000 hours in any calendar year.
3—100 hours in any calendar month and 1,000 hours in any calendar year.

**5200.** How does deadhead transportation affect the computation of flight time limits for air carrier flight crewmembers? It is

1—considered part of the rest period if the flightcrew includes more than two pilots.
2—not considered part of the rest period.
3—considered part of the rest period for flight engineers and navigators.

**5201.** A flag air carrier may schedule a pilot of any airplane, having two pilots and one additional crewmember, for no more than

1—8 hours during any 12 consecutive hours.
2—10 hours during any 12 consecutive hours.
3—12 hours during any 24 consecutive hours.

**5202.** What is the maximum flight time in 24 consecutive hours that a flag air carrier may schedule a pilot in a two-pilot crew without a rest period?

1—8 hours.
2—10 hours.
3—12 hours.

**5203.** What is the maximum number of hours a pilot may fly in 7 consecutive days as a pilot in a two-pilot crew for a flag air carrier?

1—35 hours.
2—32 hours.
3—30 hours.

**5204.** What is the maximum number of hours that a supplemental air carrier pilot may fly in 30 consecutive days?

1—100 hours.
2—120 hours.
3—300 hours.

**5205.** How many hours may a supplemental air carrier pilot on a three-pilot crew be scheduled for flight deck duty during any 24-hour period?

1—6 hours.
2—8 hours.
3—10 hours.

**5206.** The flight time limitations established for flight crewmembers include

1—all commercial flying in any flight crewmember position.
2—only commercial flying in any flight crewmember position in which FAR Part 121 operations are conducted.
3—all flight time in any flight crewmember position.

**5207.** Which passenger announcement must be made after each takeoff?

1—The location and use of emergency exits.
2—Keep seatbelts fastened while seated.
3—How to use the passenger oxygen system in an emergency.

**5208.** What information must the pilot in command of a domestic air carrier flight carry to the destination airport?

1—Cargo and passenger distribution information.
2—Copy of the flight plan.
3—Names of all crewmembers and designated pilot in command.

**5209.** How long may a domestic air carrier flight remain on the ground at an intermediate airport before a redispatch release is required?

1—1 hour.
2—2 hours.
3—6 hours.

**5210.** When an intoxicated person creates a disturbance aboard an air carrier aircraft, within what period of time must the certificate holder submit a written report, concerning the incident, to the Administrator?

1—7 days.
2—5 days.
3—48 hours.

**5211.** Which applies when carrying a passenger aboard an all-cargo aircraft?

1—The passenger must have a seat reserved on the flight deck.
2—The pilot in command may authorize the passenger to be admitted to the crew compartment.
3—Crew-type oxygen must be provided for the passenger.

**5212.** Each crewmember shall have available for individual use on each flight a

1—pyrotechnic signaling device.
2—hand fire extinguisher suitable for combating Class A, B, and C fires.
3—flashlight in good working order.

**5213.** Following the stoppage of an engine's rotation in flight, the pilot in command must, as soon as practicable, first report the occurrence to the

1—appropriate ground radio station.
2—nearest air carrier district office.
3—operations manager (or director of operations).

**5214.** Should it become necessary to shut one engine down on a domestic air carrier three-engine turbojet airplane, the pilot in command

1—may continue to the planned destination if approved by the company aircraft dispatcher.
2—may continue to the planned destination if this is considered as safe as landing at a closer airport.
3—must land at the nearest airport that a landing can be made.

**5215.** What is the maximum number of continuous hours of duty that an aircraft dispatcher may be scheduled?

1—8 hours.
2—10 hours.
3—12 hours.

**5216.** When an aircraft dispatcher declares an emergency for a flight and a deviation results, a written report shall be sent to the

1—ATC facility chief within 48 hours.
2—nearest FAA district office within 48 hours.
3—FAA Administrator within 10 days.

**5217.** When the pilot in command is responsible for a deviation during an emergency, the pilot should submit a written report within

1—48 hours after the deviation.
2—24 hours after returning to home base.
3—10 days after returning to home base.

**5218.** What action should the pilot in command follow if it is necessary to shut down one of the two engines on an air carrier airplane?

1—Land at any airport the pilot considers as safe as the nearest suitable airport in point of time.
2—Proceed to the airport specified by the company dispatcher.
3—Land at the nearest suitable airport in point of time at which a safe landing can be made.

**5219.** Assuring that appropriate aeronautical charts are aboard an aircraft is the responsibility of the

1—aircraft dispatcher.
2—flight navigator.
3—pilot in command.

**5220.** Which persons are jointly responsible for the initiation, continuation, diversion, and termination of a supplemental air carrier or commercial operator flight?

1—Pilot in command and aircraft dispatcher.
2—Director of operations and chief pilot.
3—Pilot in command and director of operations.

**5221.** The pilot in command has emergency authority to exclude any and all persons from admittance to the flight deck

1—with the exception of any certified FAA inspector.
2—as an emergency action in the interest of safety.
3—except those persons who have specific authorization of the certificate holder and the FAA.

**5222.** If an aircraft dispatcher cannot communicate with an air carrier flight during an emergency the aircraft dispatcher should

1—take any action considered necessary under the circumstances.
2—comply with the company's lost aircraft plan.
3—notify transit alert.

**5223.** Who is required to submit a written report on a deviation that occurs during an emergency?

1—Pilot in command.
2—Dispatcher.
3—Person who declares the emergency.

**5224.** When a departure alternate is required for a three-engine air carrier flight, it must be located at a distance not greater than

1—2 hours from the departure airport at normal cruising speed in still air with one engine inoperative.
2—1 hour from the departure airport at normal cruising speed in still air with one engine inoperative.
3—2 hours from the departure airport at normal cruising speed in still air.

**5225.** When is a supplemental air carrier, operating under IFR, required to list an alternate airport for each destination airport within the 48 contiguous United States?

1—When the forecast weather indicates the ceiling will be less than 2,000 feet and visibility less than 3 miles at the estimated time of arrival.
2—An alternate airport is required regardless of existing or forecast weather conditions.
3—When the flight is scheduled for more than 6 hours en route.

**5226.** If a four-engine air carrier airplane is dispatched from an airport that is below landing minimums, what is the maximum distance that a departure alternate airport may be located from the departure airport?

1—Not more than 1 hour of normal cruise speed in still air with one engine inoperative.
2—Not more than 2 hours at slow cruise speed in still air with one engine inoperative.
3—Not more than 2 hours at normal cruise speed in still air with one engine inoperative.

**5227.** What is the maximum distance required for a departure alternate airport for two-engine airplanes?

1—1 hour at normal cruise speed in still air with one engine operating.
2—1 hour at normal cruise speed in still air with both engines operating.
3—2 hours at normal cruise speed in still air with one engine operating.

**5228.** An alternate airport for the airport of takeoff is required

1—if weather conditions are below authorized landing minimums.
2—when no destination alternate airport is available.
3—when destination weather is marginal VFR (ceiling less than 3,000 feet and visibility less than 5 SM).

**5229.** When the forecast weather conditions for a destination and alternate airport are considered marginal for a domestic air carrier's operation, what specific action should the pilot in command take?

1—Delay the flight, not to exceed 1 hour, for possible weather improvement.
2—Add 1 additional hour of fuel based on cruise power settings for the airplane in use.
3—List at least one additional alternate airport.

**5230.** Which inflight conditions are required by a supplemental air carrier to conduct a day, over-the-top flight below the specified IFR minimum en route altitude?

1—The flight must remain clear of clouds by at least 500 feet vertically and 1,000 feet horizontally and have at least 3 miles flight visibility.
2—The flight must be conducted at least 1,000 feet above an overcast or broken cloud layer and have at least 5 miles flight visibility.
3—The height of any higher overcast or broken layer must be at least 500 feet above the IFR MEA.

**5231.** Prior to listing an airport as an alternate airport in the dispatch or flight release, weather reports and forecasts must indicate that weather conditions at that airport will be at or above authorized minimums

1—for a period 2 hours before and 2 hours after the ETA.
2—during the entire flight.
3—when the flight arrives.

**5232.** What minimum weather conditions must exist for an airport to be listed as an alternate in the dispatch release for a domestic air carrier flight? Those

1—listed on the NOAA IAP chart for the alternate airport, at the time the flight is expected to arrive.
2—specified in the certificate holder's operations specifications for that airport, when the flight arrives.
3—listed on the NOAA IAP chart for the alternate airport, from 2 hours before to 2 hours after the ETA for that flight.

**5233.** Which dispatch requirement applies to a flag air carrier scheduled for a 7-hour IFR flight?

1—No alternate airport is required if the forecast weather at the ETA at the destination airport is at least 1,500 feet and 3 miles.
2—An alternate airport is required.
3—An alternate airport is required only if it is specified in the International Flight Information Manual.

**5234.** An airport is not listed in a domestic air carrier's operations specifications and does not have prescribed takeoff weather minimums. What are the minimum weather conditions for takeoff?

1—1000-3.
2—900-2.
3—800-2.

**5235.** The pilot in command of an airplane en route determines that icing conditions can be expected that might adversely affect safety of the flight. Which action is appropriate?

1—The pilot in command and the company dispatcher must jointly decide whether or not the flight may continue to the original destination airport.
2—The pilot in command shall not continue flight into the icing conditions.
3—The flight may continue to the original destination airport, provided all anti-icing and deicing equipment is operational and is used.

**5236.** What action is required prior to takeoff if snow is adhering to the wings of an air carrier airplane?

1—Turn on wing deice prior to takeoff.
2—Assure that the snow is removed.
3—Add 15 knots to the normal $V_R$ speed.

**5237.** When an alternate airport outside the United States has no prescribed takeoff minimums and is not listed in a flag air carrier's operations specifications, what minimum weather conditions will meet the requirements for takeoff?

1—800-2-1/2.
2—800-3.
3—900-1-1/2.

**5238.** What minimum weather conditions must exist for a domestic air carrier flight to take off from an airport within the United States which is not listed in the air carrier's operations specifications? (Takeoff minimums are not prescribed for that airport.)

1—800-2, 100-1/2, or 1500-1.
2—800-2, 900-1-1/2, or l000-1.
3—600-3, 1000-2, or 1200-1.

**5239.** An alternate airport is not required to dispatch a flag air carrier airplane for a flight less than 6 hours when the visibility for at least 1 hour before and 1 hour after the ETA at the destination airport is forecast to be

1—2 miles or greater.
2—at least 3 miles, or 2 miles more than the lowest applicable minimum.
3—at least 5 miles.

**5240.** Which weather conditions meet the minimum requirements for a flag air carrier to take off from an alternate airport that is not listed in the operation specifications?

1—800-1/2, 900-1, 1000-2.
2—800-1, 900-2, 1000-3.
3—800-2, 900-1-1/2, 1000-1.

**5241.** When a domestic air carrier airplane lands at an intermediate airport at 1815Z, what is the latest time it may depart that airport without a specific authorization from an aircraft dispatcher?

1—1945Z.
2—1915Z.
3—1845Z.

**5242.** When a flag air carrier flight lands at an intermediate airport at 1805Z, what is the latest time it may depart without being redispatched?

1—0005Z.
2—2005Z.
3—1905Z.

**5243.** When a flag air carrier airplane lands at an intermediate airport at 1322Z, what is the latest time it may continue a flight without receiving a redispatch authorization?

1—1922Z.
2—1622Z.
3—1422Z.

**5244.** When a flag air carrier flight lands at an intermediate airport at 1345Z, and experiences a delay, what is the latest time it may depart for the next airport without a redispatch release?

1—1945Z.
2—1545Z
3—1445Z.

**5245.** The reserve fuel supply for a domestic air carrier flight is

1—30 minutes of holding fuel consumption 1,500 feet above the destination or alternate airport.
2—45 minutes at normal fuel consumption in addition to the fuel required to the most distant alternate airport.
3—45 minutes of holding fuel consumption 1,500 feet above the destination or alternate airport.

**5246.** What is the minimum fuel required by a flag air carrier turbojet airplane on a flight within the 48 contiguous United States, after reaching the most distant alternate airport?

1—45 minutes at normal cruising fuel consumption.
2—2 hours at normal cruising fuel consumption.
3—Enough fuel to return to the destination airport.

**5247.** What is the fuel reserve requirement for a commercially operated reciprocating-engine-powered airplane flying within the contiguous United States upon arrival at the most distant alternate airport specified in the flight release? Enough fuel to fly

1—30 minutes plus 15 percent of total time required to fly at normal cruising consumption to the alternate.
2—45 minutes at normal cruising fuel consumption.
3—15 minutes plus 30 percent of the total time required to fly to the alternate at normal cruising fuel consumption.

**5248.** For a flag air carrier flight to be released to an island airport for which an alternate airport is not available, a turbojet-powered airplane must have enough fuel to fly to that airport and thereafter to fly

1—for 2 hours at normal cruising fuel consumption.
2—for 2 hours at a fuel consumption computed for 10,000 feet MSL at a specific weight and holding airspeed.
3—back to the departure airport.

**5249.** An alternate airport is not required for a supplemental or commercial air carrier, turbojet-powered airplane on an IFR flight outside the 48 contiguous states, if

1—a fuel reserve for 30 minutes, plus 15 percent of the total flight time, is carried aboard the airplane.
2—enough fuel is aboard the airplane to fly to the destination and thereafter to fly for at least 2 hours at normal cruising fuel consumption.
3—enough fuel to fly for 30 minutes at holding airspeed at 1,500 feet AGL is carried aboard the airplane.

**5250.** What is the fuel reserve required for a turbine-engine-powered (other than turbopropeller) supplemental air carrier airplane upon arrival over the most distant alternate airport outside the contiguous United States?

1—30 minutes at holding speed.
2—45 minutes at normal cruising speed.
3—2 hours at normal cruise fuel consumption.

**5251.** Upon arriving at the most distant airport, what is the fuel reserve requirement for a turbopropeller flag air carrier airplane.

1—30 minutes at the most economical altitude for fuel consumption at holding speed.
2—45 minutes at holding altitude.
3—30 minutes plus 15 percent of the total time required, or 90 minutes at normal cruise, whichever is less.

**5252.** What is the fuel reserve required for a turbopropeller supplemental air carrier airplane upon the arrival at a destination airport for which an alternate airport is not specified

1—30 minutes at holding airspeed.
2—2 hours at normal cruising fuel consumption.
3—3 hours at normal cruising fuel consumption.

**5253.** When a turbine-engine-powered flag air carrier airplane is released to an airport which has no available alternate, what is the required fuel reserve?

1—1 hour 30 minutes at maximum range airspeed.
2—2 hours at normal cruise fuel consumption.
3—30 minutes plus 10 percent of the total flight time.

**5254.** What is the fuel reserve required for a reciprocating-engine-powered supplemental air carrier airplane upon arrival at the most distant alternate airport during a flight within the contiguous United States?

1—45 minutes at normal cruising fuel consumption.
2—2 hours at normal cruising fuel consumption.
3—3 hours at normal cruising fuel consumption.

**5255.** If an instrument on a multiengine airplane is inoperative, which document dictates whether the flight may continue en route?

1—Amended flight/dispatch release.
2—Original dispatch release.
3—Certificate holder's manual.

**5256.** Under what conditions may an air carrier pilot continue an instrument approach to the DH or MDA, after receiving a weather report indicating that less than minimum published landing conditions exist at the airport?

1—If the instrument approach is conducted in a radar environment.
2—When the weather report is received after the pilot has been cleared for an instrument approach.
3—When the weather report is received after the pilot has begun the final approach segment of an instrument approach.

**5257.** By regulation, who shall provide the pilot in command of a domestic or flag air carrier airplane, information concerning irregularities of facilities and services?

1—Air route traffic control center.
2—Director of operations.
3—Aircraft dispatcher.

**5258.** Who is responsible for obtaining information on all current airport conditions and irregularities of navigation facilities for a supplemental air carrier flight?

1—Aircraft dispatcher.
2—Director of operations.
3—Pilot in command.

**5259.** During a supplemental air carrier flight, who is responsible for obtaining information on meteorological conditions?

1—Aircraft dispatcher.
2—Pilot in command.
3—Director of operations.

**5260.** Where can the pilot of a flag air carrier airplane find the latest FDC NOTAM's?

1—Any company dispatch facility.
2—In the standard instrument approach procedures book.
3—Airport/Facility Directory.

**5261.** Who is responsible, by regulation, for briefing a domestic or flag air carrier pilot in command on all available weather information?

1—FSS.
2—Aircraft dispatcher.
3—Director of operations.

**5262.** Category II ILS operations below 1600 RVR and a 150-foot DH may be approved after the pilot has

1—successfully completed an FAA-approved Category II training program.
2—made at least six Category II approaches in actual IFR conditions with 100-foot DH within the preceding 12 calendar months.
3—logged 100 hours' flight time in make and model airplane and three Category II ILS approaches in actual or simulated IFR conditions with 150-foot DH since the beginning of the sixth preceding month.

**5263.** When a pilot's flight time consists of 80 hours' pilot in command in a particular type airplane, how does this affect the MDA, DH, or minimum visibility for the destination airport?

1—Has no effect.
2—MDA or DH and visibility minimums are decreased by 100 feet and 1/2 mile.
3—MDA or DH and visibility minimums are increased by 100 feet and 1/2 mile.

**5264.** Which information must be contained in, or attached to, the dispatch release for a flag air carrier flight?

1—Type of operation (e.g., IFR, VFR).
2—Total fuel supply on board the airplane.
3—Passenger manifest and cargo weight.

**5265.** Which certificated air carrier operators must attach to, or include on, the flight release form the name of each flight crewmember, flight attendant, and designated pilot in command?

1—Supplemental and commercial.
2—Supplemental and domestic.
3—Flag and commercial.

**5266.** What information must be contained in, or attached to, the dispatch release for a domestic air carrier flight?

1—Departure airport, immediate stops, destinations, and alternate airports.
2—Names of all passengers on board.
3—Cargo load and weight and balance data.

**5267.** What information must be included on a domestic air carrier dispatch release?

1—Evidence that the airplane is loaded according to schedule.
2—Minimum fuel supply.
3—Company or organization name.

**5268.** A dispatch release for a flag or domestic air carrier must contain or have attached to it

1—weather information for the complete flight.
2—weight and balance data.
3—a crew list.

**5269.** What information is required in the flight release for supplemental air carriers and commercial operators that is not required in the dispatch release for flag and domestic air carriers?

1—Weather reports and forecasts.
2—Names of all crewmembers.
3—Minimum fuel supply.

**5270.** Which documents are required to be carried aboard each flag air carrier flight?

1—Dispatch release and weight and balance release.
2—Load manifest and flight release.
3—Dispatch release, load manifest, and flight plan.

**5271.** Which documents are required to be carried aboard each domestic air carrier flight?

1—Dispatch release, load manifest, and flight plan.
2—Dispatch release and weight and balance release.
3—Load manifest and flight release.

**5272.** How long shall a supplemental air carrier or commercial operator retain a record of the load manifest, flight release, and flight plan?

1—1 month.
2—3 months.
3—12 months.

**5273.** A domestic or flag air carrier shall keep copies of the flight plans, dispatch releases, and load manifests for at least

1—6 months.
2—3 months.
3—30 days.

**5274.** A flag air carrier flight which requires three pilots is scheduled to operate on August 5. Each of the pilots has a First-Class Medical Certificate dated January 26 of the same year. For this scheduled flight

1—all three pilots must have new medical certificates prior to departure.
2—only the pilots serving as pilot in command and second in command must have new medical certificates prior to departure.
3—these medical certificates are adequate for each of the pilot positions.

**5275.** A certificate holder must have "exclusive use" of

1—at lease one aircraft for each operation authorized in the certificate holder's manual.
2—at least one aircraft that meets the requirements of the specific operations authorized in the certificate holder's operations specifications.
3—at least one aircraft that meets the requirements of at least one kind of operation authorized in the certificate holder's operations specifications.

**5276.** Which document specifically authorizes a person to operate an aircraft in a particular geographic area?

1—Certificate of designation.
2—Air taxi operating certificate.
3—Operations specifications.

**5277.** If previous arrangements have not been made by the operator, where can the procedures for servicing the aircraft be found?

1—Certificate holder's director of maintenance.
2—Certificate holder's manual.
3—Part E of the certificate holder's operations specifications.

**5278.** What document contains procedures that explain how the required return-to-service conditions have been met?

1—Certificate holder's manual.
2—Mechanical Interruption Summary Report.
3—Operations Inspections and Surveillance Procedures Handbook.

**5279.** Who is responsible for keeping copies of the certificate holder's manual up to date with approved changes or additions?

1—Each employee of the certificate holder who is furnished a manual.
2—Air Taxi/Commercial Technical Service.
3—A representative of the Administrator assigned to the certificate holder.

**5280.** An aircraft may be operated in a foreign country by a FAR Part 135 operator only if authorized to do so by

1—an FAA International Field Office.
2—the ICAO (International Civil Aviation Organization).
3—the foreign country.

**5281.** Who is responsible for the preparation of a required load manifest?

1—Dispatcher.
2—Air carrier certificate holder.
3—Company official specifically designated by the Administrator.

**5282.** Which is not a required item on the load manifest?

1—Aircraft registration or flight number.
2—List of passenger names.
3—Identification of crewmembers.

**5283.** A certificate holder must keep copies of completed load manifests for at least

1—30 days.
2—90 days.
3—60 days.

**5284.** Before each flight, who is directly responsible for determining the airworthiness status of a mechanical irregularity previously entered in the aircraft maintenance log?

1—Aircraft dispatcher.
2—Line maintenance supervisor.
3—Pilot in command of next flight.

**5285.** Where is the certificate holder required to list the name and title of each person authorized to exercise operational control for a particular flight?

1—Part B of the certificate holder's Operations Specifications.
2—Attached to the load manifest for that flight.
3—Certificate holder's manual.

**5286.** Procedures for keeping copies of the aircraft maintenance log in the aircraft and available to appropriate personnel shall be set forth in

1—the certificate holder's manual.
2—the aircraft maintenance procedures handbook.
3—Part D of the operations specifications.

**5287.** Which person, other than the second in command, may the pilot in command permit to manipulate the flight controls?

1—When authorized by the certificate holder, a passenger who holds a pilot certificate appropriate for the aircraft.
2—An authorized FAA safety representative who is qualified in the aircraft, and is checking flight operations.
3—A pilot employed by an engineering firm who is authorized by the certificate holder to conduct flight tests.

**5288.** The maximum altitude loss for a malfunctioning autopilot without an approach coupler is 45 feet. If the MDA is 1,620 feet MSL and the touchdown zone elevation is 1,294 feet, to which minimum altitude may you use the autopilot?

1—1,510 feet MSL.
2—1,339 feet MSL.
3—1,570 feet MSL.

**5289.** The maximum altitude loss for a malfunctioning autopilot with an approach coupler is 40 feet. To which minimum altitude may the autopilot be used during an ILS approach in less than basic VFR conditions?

1—40 feet AGL.
2—50 feet AGL.
3—80 feet AGL.

**5290.** The maximum altitude loss for a particular malfunctioning autopilot under approach conditions is 55 feet. If the touchdown zone elevation is 571 feet and the MDA is 1,100 feet, to which minimum altitude may you use this autopilot?

1—626 feet MSL.
2—990 feet MSL.
3—1,050 feet MSL.

**5291.** The maximum altitude loss specified for malfunction of a certain autopilot under cruise conditions is 50 feet. What is the lowest altitude this autopilot may be used en route?

1—550 feet AGL.
2—600 feet AGL.
3—500 feet AGL.

**5292.** What is the lowest altitude above the terrain that an autopilot may be used during en route operations, if the airplane flight manual specifies a malfunction under cruise conditions?

1—100 feet.
2—500 feet.
3—1,000 feet.

**5293.** The altitude loss for a particular malfunctioning autopilot with an approach coupler is 60 feet. If the reported weather is below basic VFR minimums and an ILS approach using the approach coupler is to be used, what minimum altitude may be used?

1—50 feet AGL.
2—60 feet AGL.
3—100 feet AGL.

**5294.** An autopilot may be used in place of a second in command in any aircraft

1—being operated in commuter air carrier service.
2—having a passenger seating configuration, excluding any pilot's seat, of 10 seats or more.
3—having a total seating capacity of more than eight seats and being operated in commuter air service.

**5295.** Which is a condition that must be met by a commuter air carrier certificate holder to have an aircraft approved for operation with an autopilot system and no second in command?

1—The passenger seating configuration is 12 or less, excluding any pilot seat.
2—The autopilot system is capable of operating the controls to maintain flight and to maneuver the aircraft about the three axes.
3—The operation is restricted to VFR or VFR over-the-top.

**5296.** A commuter air carrier certificate holder plans to assign a pilot as pilot in command of an aircraft having eight passenger seats to be used in passenger-carrying operations. Which experience requirement must that pilot meet if the aircraft is to be flown with an autopilot and no second in command?

1—100 hours as pilot in command in the make and model.
2—100 hours in the category, class, and type.
3—50 hours and 10 landings as pilot in command in the make and model.

**5297.** Who may be allowed to carry a deadly weapon on board an aircraft operated under FAR Part 135?

1—Official bodyguards attached to foreign legations.
2—Security officers employed by corporate executives.
3—Employees of a municipality or state authorized to carry arms.

**5298.** Which restriction must be observed regarding the carrying of cargo in the passenger compartment?

1—Cargo must be properly secured by a safety belt or other approved tiedown.
2—All cargo must be carried in a suitable bin and secured to a passenger seat or the floor structure of the aircraft.
3—Cargo carried in passenger seats must be forward of all passengers.

**5299.** Which person may be carried aboard an aircraft without complying with the passenger-carrying requirements of FAR Part 135?

1—An authorized technical representative of an aircraft or engine company.
2—A member of the United States diplomatic corps on an official courier mission.
3—An individual who is necessary for the safe handling of animals on the aircraft.

**5300.** In a cargo-only operation, cargo must be loaded

1—so that it does not obstruct the aisle between the crew and cargo compartments.
2—in such a manner that at least one emergency or regular exit is available to all occupants.
3—so that all required flight crewmembers have ready access to all regular and emergency exits.

**5301.** Which is a requirement governing the carriage of cargo?

1—Cargo must be carried in an approved rack, bin, or compartment.
2—Cargo not stowed in an approved bin must be secured by a safety belt or approved tiedown device.
3—All cargo carried in the passenger compartment must be packaged and stowed ahead of the foremost seated passenger.

**5302.** Which is a requirement governing the carriage of carry-on baggage?

1—All carry-on baggage must be restrained so that its movement is prevented during turbulence.
2—Carry-on baggage must be stowed ahead of all seated occupants.
3—Pieces of carry-on baggage weighing more than 10 pounds must be carried in an approved rack or bin.

**5303.** If carry-on baggage or cargo is carried in the passenger compartment, it must be

1—stowed ahead of the foremost seated passengers.
2—placed in an approved rack, bin, or compartment installed in the aircraft.
3—so located that it does not obstruct the aisle between the crew and passenger compartments.

**5304.** The load manifest must be prepared prior to each takeoff for

1—any aircraft with a passenger seating capacity of 10 seats or more.
2—multiengine aircraft only.
3—all helicopters and large aircraft operated by a commuter air carrier.

**5305.** Which minimum passenger seating configuration requires a second in command?

1—10 seats.
2—12 seats.
3—15 seats.

**5306.** A flight attendant crewmember is required on aircraft having a passenger seating configuration, excluding any pilot seat, of

1—15 or more.
2—20 or more.
3—19 or more.

**5307.** Before each takeoff, the pilot in command of an aircraft carrying passengers shall ensure that all passengers have been orally briefed on the

1—location of normal and emergency exits, oxygen masks, and life preservers.
2—use of seatbelts, oxygen, and liferafts.
3—use of seatbelts, smoking, and location of survival equipment.

**5308.** Before takeoff, the pilot in command of an aircraft carrying passengers shall ensure that all passengers have been orally briefed on the normal and emergency use of oxygen

1—regardless of the altitude at which the flight will operate.
2—if the flight involves operations above 12,000 feet MSL.
3—if the flight involves operations at or above 10,000 feet MSL for more than 1 hour.

**5309.** The oral preflight briefing required on passenger-carrying aircraft shall be

1—supplemented by an actual demonstration of emergency exit door operation by a crewmember.
2—presented in person by the pilot in command while another flight crewmember demonstrates the operation of emergency equipment.
3—conducted by the pilot in command or a crewmember and supplemented by printed cards for the use of each passenger.

**5310.** Which is a requirement regarding the carriage and operation of oxygen equipment for medical use by passengers?

1—No person may smoke within 10 feet of oxygen storage and dispensing equipment.
2—When oxygen equipment is used for the medical treatment of a patient, the rules pertaining to emergency exit access are waived.
3—No person may connect oxygen bottles or any other ancillary equipment until all passengers are aboard the aircraft and seated.

**5311.** If a certificate holder deviates from the provisions of regulations which pertain to medical use of oxygen by passengers, a complete report of the incident shall be sent to the FAA within

1—48 hours.
2—7 working days.
3—10 working days.

**5312.** Which is a condition that must be met when a person is administered medical oxygen in flight?

1—The distance between a person using medical oxygen and any electrical unit must not be less than 5 feet.
2—A person using oxygen equipment must be seated to avoid restricting access to, or use of, any required exit.
3—A person being administered oxygen must be monitored by equipment that displays and records pulse and respiration.

**5313.** Which requirement applies when oxygen is stored in liquid form?

1—Liquified oxygen is a hazardous material and must be kept in an isolated storage facility.
2—The equipment used to store liquid oxygen must be included in the certificate holder's approved maintenance program.
3—Smoking is not permitted within 50 feet of stored liquid oxygen.

**5314.** Which is a pilot requirement for oxygen?

1—Each pilot of a pressurized aircraft operating at 18,000 feet MSL and above shall have an approved quick-donning type oxygen mask.
2—On pressurized aircraft requiring a flightcrew of two pilots, both shall continuously wear oxygen masks whenever the cabin pressure altitude exceeds 12,000 feet MSL.
3—On unpressurized aircraft, flying above 12,000 feet MSL, pilots shall use oxygen continuously.

**5315.** Which is a requirement for pilot use of oxygen in a pressurized airplane?

1—At altitudes of 18,000 feet MSL and above, each pilot shall have an approved quick-donning oxygen mask.
2—The pilot at the controls shall use oxygen continuously any time the cabin pressure altitude is more than 12,000 feet MSL.
3—At altitudes above 20,000 feet MSL, the pilot at the controls must use an approved oxygen mask any time the other pilot is away from the duty station.

**5316.** Above which altitude must at least one pilot at the controls of a pressurized aircraft wear a secured and sealed oxygen mask?

1—30,000 feet MSL.
2—35,000 feet MSL.
3—41,000 feet MSL.

**5317.** Which is a requirement for flightcrew use of oxygen masks in a pressurized cabin airplane?

1—At altitudes above FL250, one of the two pilots at the controls shall use an oxygen mask continuously.
2—Both pilots at the controls shall use oxygen masks above FL300.
3—At altitudes above 25,000 feet MSL, if one pilot leaves the pilot duty station, the remaining pilot at the controls shall use an oxygen mask.

**5318.** At altitudes above 10,000 feet through 12,000 feet MSL, each pilot of an unpressurized airplane must use supplemental oxygen for that part of the flight that is of a duration of more than

1—20 minutes.
2—30 minutes.
3—45 minutes.

**5319.** The two pilot stations of a pressurized aircraft are equipped with approved quick-donning oxygen masks. What is the maximum altitude authorized without one pilot wearing and using an oxygen mask?

1—25,000 feet MSL.
2—35,000 feet MSL.
3—41,000 feet MSL.

**5320.** In airplanes where a third gyroscopic bank-and-pitch indicator is required, that instrument must

1—continue reliable operation for at least 45 minutes after the output of the airplane's electrical generating system falls below an optimum level.
2—be operable by a selector switch which may be actuated from either pilot station.
3—continue reliable operation for a minimum of 30 minutes after total failure of the aircraft's electrical generating system.

**5321.** In which aircraft operating under FAR Part 135 is a third gyroscopic bank-and-pitch indicator required?

1—All turbojet airplanes.
2—All airplanes where the flightcrew of pilot in command and second in command are required.
3—All airplanes having a passenger seating capacity of 30 seats or more.

**5322.** To operate a multiengine aircraft with certain equipment inoperative under the provisions of a minimum equipment list, what document must be carried within the aircraft?

1—Letter from the Regional Airworthiness Office authorizing such operation.
2—Letter from the certificate holder's director of maintenance authorizing the operation.
3—Letter of Authorization issued by the FAA district office having certification responsibility.

**5323.** What performance is required of a multiengine airplane with the critical engine inoperative, while carrying passengers for hire in IFR weather conditions?

1—Climb at least 100 feet a minute at the highest MEA of the route to be flown or 3,000 feet MSL, whichever is higher.
2—Climb at least 50 feet a minute at the MEA's of the route to be flown or 5,000 feet MSL, whichever is higher.
3—Maintain altitude at the highest MEA of the route to be flown or 5,000 feet MSL, whichever is higher.

**5324.** Which performance requirement applies to passenger-carrying land airplanes being operated over water?

1—Multiengine airplanes must be able to climb, with the critical engine inoperative, at least 100 feet a minute at 1,500 feet above the surface.
2—Single-engine airplanes must be operated at an altitude that will allow them to reach land in case of engine failure.
3—Both single-engine and multiengine airplanes must have integral flotation devices that will keep them afloat in event of ditching.

**5325.** The weight and CG of an aircraft used in air taxi service must have been calculated from those values established by actual weighing of the aircraft within what period of time?

1—Multiengine aircraft, 24 calendar months; single-engine, 36 calendar months.
2—Multiengine aircraft, 36 calendar months.
3—Multiengine and single-engine aircraft, 36 calendar months.

**5326.** Which aircraft must be equipped with an approved public address and crewmember interphone system?

1—All turbine-engine-powered aircraft in passenger-carrying operations.
2—Aircraft having a passenger seating configuration, excluding any pilot seat, of more than 19 seats.
3—Multiengine aircraft having a passenger seating configuration of 10 seats or more.

**5327.** Information recorded during normal operations by a required cockpit voice recorder

1—must be retained for at least 12 hours.
2—may be erased only once each flight.
3—may be erased, except the last 30 minutes.

**5328.** An approved cockpit voice recorder is required equipment in

1—large airplanes having a maximum passenger capacity of more than 19 seats.
2—turbojet-powered airplanes having a passenger seating configuration, excluding any pilot seat, of 10 seats or more.
3—all aircraft operated in commuter air carrier service having a passenger seating configuration of 19 seats or more.

**5329.** During which time period must a required voice recorder of a passenger-carrying airplane be continuously operated?

1—From the beginning of taxi to the end of the landing roll.
2—From engine start at departure airport to engine shutdown at landing airport.
3—From the use of the checklist before the flight to completion of the final check at the end of the flight.

**5330.** In which airplanes is a ground proximity warning system required?

1—All airplanes having a passenger seating configuration, excluding any pilot seat, of 10 seats or more.
2—Airplanes having a passenger seating configuration of 19 seats or more, being operated in commuter air service.
3—Turbojet-powered airplanes having a passenger seating configuration, excluding any pilot seat, of 10 seats or more.

**5331.** When a ground proximity warning system is required under FAR Part 135, it must

1—convey warnings for excessive closure rates with the terrain but not for deviation from an ILS glide slope.
2—alert the pilot by an audible warning signal when deviation above or below glide slope occurs.
3—convey warnings of any deviation below glide slope and of excessive closure rate with the terrain.

**5332.** When a ground proximity warning system is required, it must

1—incorporate a means of alerting the pilot when a malfunction occurs.
2—apply corrective control pressure when deviation below glide slope occurs.
3—incorporate a backup feature that activates automatically upon total failure of the aircraft's electrical generating system.

**5333.** A pressurized airplane being operated at FL300 can descend safely to 15,000 feet MSL in 4 minutes. What oxygen supply must be carried for all occupants other than the pilots?

1—30 minutes.
2—45 minutes.
3—1 hour.

**5334.** Above what altitude in an unpressurized airplane, must all passengers be supplied oxygen?

1—12,000 feet MSL.
2—14,000 feet MSL.
3—15,000 feet MSL.

**5335.** Between what altitudes in an unpressurized airplane must oxygen be available to at least 10 percent of the occupants, other than the pilots?

1—Above 10,000 feet through 15,000 feet MSL, if flight at those altitudes is of more than a 30-minute duration.
2—Above 12,000 feet through 16,000 feet MSL, for any time period.
3—Above 12,000 feet through 15,000 feet MSL, if flight at those altitudes is of more than a 15-minute duration.

**5336.** An unpressurized aircraft with 10 occupants other than the pilots, will be cruising at 11,000 feet MSL for 20 minutes. For how many, if any, of these occupants must there be an oxygen supply?

1—Five.
2—One.
3—None.

**5337.** The oxygen requirements for occupants of a pressurized airplane operated at altitudes above 24,000 feet MSL is dependent upon the airplane's ability to descend safely to an altitude of

1—10,000 feet MSL in 4 minutes.
2—15,000 feet MSL in 4 minutes.
3—12,000 feet MSL at a minimum rate of 2,500 ft/min.

**5338.** In addition to fully-equipped liferafts and life preservers, what emergency equipment must be provided during extended overwater operations?

1—One water resistant, self-buoyant, portable emergency radio transmitter for each 10 occupants.
2—One survival-type emergency locator transmitter.
3—One pyrotechnic signaling device for each 10 occupants.

**5339.** Which is a requirement for life preservers during extended overwater operations? Each life preserver must be equipped with

1—an approved survivor locator light.
2—a dye marker.
3—one flashlight having at least two size "D" cells or equivalent.

**5340.** Which aircraft must have a shoulder harness installed at each flight crewmember station?

1—Aircraft having a passenger seating configuration, excluding any pilot seat, of 10 seats or more.
2—All passenger-carrying aircraft operating under FAR Part 135.
3—Large aircraft being operated in commuter air service.

**5341.** Under which condition is a pilot not required to keep the shoulder harness fastened during takeoff and landing while at a pilot station?

1—When operating an aircraft having a passenger seating configuration, excluding any pilot seat, of 10 seats or less.
2—When the pilot cannot perform the required duties with the shoulder harness fastened.
3—When serving as pilot in command or second in command of an aircraft having a total seating capacity of eight seats or less.

**5342.** Which airplanes must have a shoulder harness installed at each flight crewmember station?

1—All airplanes operating under FAR Part 135.
2—All turbojet-powered airplanes.
3—All airplanes used in commuter air service.

**5343.** In which aircraft, or under what conditions, is airborne thunderstorm detection equipment required?

1—Multiengine turbine-powerd aircraft having a passenger seating configuration of 19 seats or more being operated by a commuter air carrier.
2—Any aircraft having a passenger seating configuration of 19 seats or more that is engaged in passenger-carrying operations under IFR or at night.
3—Small multiengine aircraft having a passenger seating configuration of 10 seats or more, excluding any pilot seat, that are engaged in passenger-carrying operations.

**5344.** Airborne weather radar equipment must be installed in large transport category aircraft in the conterminous 48 United States

1—and be fully operational, although weather forecasts indicate no hazardous conditions.
2—engaged in passenger-carrying operations.
3—engaged in either cargo or passenger-carrying operations.

**5345.** An aircraft has a passenger seating configuration of 16 seats, excluding any pilot seats. How many, if any, approved first aid kits are required?

1—One.
2—Two.
3—None.

**5346.** How many, if any, approved first aid kits are required on an aircraft having a passenger seating configuration of 20 seats and a passenger load of 14?

1—None.
2—One.
3—Two.

**5347.** When a crash ax is required equipment on an aircraft, where should it be located?

1—As close as practicable to an emergency exit.
2—At a location where it is inaccessible to the passengers during normal operations.
3—At a location where it is accessible to both the crew and passengers during normal operations.

**5348.** A pilot may make an IFR departure from an airport that does not have an approved standard instrument approach procedure if the

1—certificate holder holds a waiver from ATC approving the procedure.
2—certificate holder has been issued operations specifications by the Administrator approving the procedure.
3—departure airport is within 30 minutes or less flying time of another airport that has an approved standard instrument approach procedure.

**5349.** Which condition must be met to conduct IFR operations from an airport that is not at the location where weather observations are made?

1—The Administrator must issue operations specifications that permit the procedure.
2—A "Letter of Waiver" authorizing the procedure must be issued by the U.S. National Weather Service.
3—An "Authorization Letter" permitting the procedure must be issued to the operator by the supervising FAA district office.

**5350.** What are the empty weight and balance currency requirements for aircraft used in air taxi service?

1—The empty weight and CG of multiengine and single-engine aircraft must have been calculated from an actual weighing within the previous 24 calendar months.
2—The empty weight and CG of multiengine aircraft must have been calculated from an actual weighing within the previous 36 calendar months.
3—The empty weight and CG must have been calculated from an actual weighing within the previous 24 calendar months unless the original Airworthiness Certificate was issued within the previous 36 calendar months.

**5351.** A pilot may not begin an IFR operation unless the next airport of intended landing is forecast to be at or above authorized IFR landing minimums at

1—the estimated time of arrival.
2—the estimated time of arrival, plus or minus 1 hour.
3—30 minutes before, until 30 minutes after, the estimated time of arrival.

**5352.** A takeoff may not be made from an airport that is below the authorized IFR landing minimums unless

1—there is an alternate airport with the required IFR landing minimums within 45 minutes' flying time.
2—the departure airport is forecast to have the required IFR landing minimums within 1 hour.
3—there is an alternate airport with the required IFR landing minimums within 1-hour's flying time.

**5353.** A pilot may not designate an airport as an alternate unless it is forecast to be at or above alternate minimums at

1—the time of departure.
2—the estimated time of arrival, plus or minus 1 hour.
3—the estimated time of arrival.

**5354.** Assuming the required ceiling exists, an alternate for the destination airport is not required if, for at least 1 hour before and after the ETA, the forecast visibility is at least

1—5 miles, or 3 miles more than the lowest applicable visibility minimums for the instrument approach procedure to be used, whichever is greater.
2—3 miles, or 2 miles more than the lowest applicable visibility minimums for the instrument approach procedure to be used, whichever is greater.
3—5 miles, or 3 miles more than the lowest applicable circling minimums.

**5355.** The required visibility exists and circling is not authorized. An alternate for the destination airport is not required if, for at least 1 hour before and after the ETA, the forecast ceiling is at least

1—1,500 feet above the lowest published minimum, or 2,000 feet above the airport elevation, whichever is higher.
2—1,000 feet above the lowest MEA, MOCA, or altitude prescribed for the initial approach procedure for the airport.
3—1,000 feet above the lowest published minimum, or 1,500 feet above the airport elevation, whichever is higher.

**5356.** If the weather forecasts do not require the listing of an alternate airport on an IFR flight, the airplane must carry sufficient fuel to fly to the destination airport and

1—fly thereafter for 45 minutes at normal cruising speed.
2—fly thereafter for 30 minutes at normal cruising speed.
3—make one missed approach and thereafter have a 45-minute reserve at normal cruising speed.

**5357.** If the weather forecasts require the listing of an alternate airport on an IFR flight, the airplane must carry enough fuel to fly to the first airport of intended landing, then to the alternate, and fly thereafter for a minimum of

1—30 minutes.
2—20 minutes.
3—45 minutes.

**5358.** At a foreign airport, a pilot may not take off under IFR unless the reported weather conditions indicate that the

1—visibility is 1 mile or more.
2—ceiling is at least 500 feet and the visibility is 1 mile or more.
3—visibility is 1/2 mile or more.

**5359.** A pilot may not take off under IFR at a military airport unless the visibility is

1—at least 1 mile.
2—1/2 mile or more.
3—3/4 mile or more.

**5360.** A pilot may not make an instrument approach at a military or foreign airport unless the minimum visibility is at least

1—1/2 mile.
2—RVR 32.
3—RVR 40.

**5361.** An instrument approach procedure to an airport may not be initiated unless the latest weather report issued by an authorized weather reporting facility indicates that weather conditions

1—are at or above the circling minimums for the runway the pilot intends to use.
2—exceed the straight-in minimums for all nonprecision approaches.
3—are at or above the authorized IFR landing minimums for that procedure.

**5362.** After passing the final approach fix on a VOR approach, a weather report is received indicating the visibility is below prescribed minimums. In this situation, the pilot

1—may continue the approach and land, if at the MDA the visibility is at least equal to the required minimums.
2—should continue the approach to the MDA, and regardless of the visibility, execute a missed approach.
3—continue the approach and land regardless of the visibility you observe at the MDA, if prior to beginning the approach, the visibility was reported at or above minimums.

**5363.** Which is one required condition for a pilot to take off under IFR with less-than-standard takeoff minimums at an airport where a straight-in instrument approach procedure is authorized and there is an approved weather reporting source?

1—The pilot must have at least 100 hours as pilot in command in the type airplane to be flown.
2—Visibility at time of takeoff must be at least RVR 16.
3—Wind direction and velocity must be such that a straight-in approach can be made to the runway served by the procedure.

**5364.** Which is an operational requirement concerning ice, snow, or frost on structural surfaces?

1—A takeoff may not be made if ice or snow is adhering to the wings or stabilizing or control surfaces.
2—A takeoff may be made with ice, snow, or frost adhering to the wings or stabilizing or control surfaces if anti-icing and deicing equipment is operating.
3—If snow, ice, or frost is adhering to the airplane's lift or control surfaces, but polished smooth, a takeoff may be made.

**5365.** What are the minimum certificate and rating requirements for the pilot in command of a multiengine airplane in commuter air carrier service under IFR?

1—Airline transport pilot of any category; multiengine class rating.
2—Airline transport pilot; airplane category; multiengine class rating; airplane type rating, if required.
3—Commercial pilot; airplane category; multiengine class and instrument rating.

**5366.** A multiengine airplane is being operated by a commuter air carrier. What are the minimum certificate and rating requirements for the pilot in command?

1—Airline transport pilot; airplane category; multiengine class; airplane type rating, if required.
2—Commercial pilot; airplane category; multiengine class; instrument rating; airplane type rating, if required.
3—Airline transport pilot; airplane category; multiengine class.

**5367.** What are the minimum certificate and rating requirements for the pilot in command of a turbojet airplane with two engines?

1—Airline transport pilot of any category; multiengine class rating; airplane type rating.
2—Airline transport pilot; airplane category; multiengine class rating; airplane type rating, if required.
3—Commercial pilot; airplane category; multiengine class rating; instrument rating; airplane type rating.

**5368.** A person is designated pilot in command of a multiengine, reciprocating-engine-powered airplane operated in passenger-carrying service by a commuter air carrier. If five takeoffs and landings are accomplished in that make and basic model, which additional pilot-in-command experience meets the requirement for designation?

1—Two takeoffs and landings, and 8 hours.
2—Five takeoffs and landings, and 5 hours.
3—Three takeoffs and landings, and 6 hours.

**5369.** A person is designated as pilot in command of a turbojet-powered airplane operated in passenger-carrying service by a commuter air carrier. If 10 takeoffs and landings are accomplished in that make and basic model, which additional pilot-in-command experience meets the requirement for designation?

1—10 hours.
2—10 hours, and five takeoffs and landings.
3—15 hours.

**5370.** A pilot's experience includes 8 hours in a particular make and basic model multiengine, turboprop airplane. Which additional pilot-in-command experience meets the requirements for designation as pilot in command of that airplane when operated by a commuter air carrier in passenger-carrying service?

1—Five takeoffs and landings, and 2 hours.
2—Ten takeoffs and landings, and 2 hours.
3—Twelve takeoffs and landings.

**5371.** A person is designated pilot in command of a single-engine airplane operated in passenger-carrying service by a commuter air carrier. If seven takeoffs and landings are accomplished in that make and basic model, which additional pilot-in-command experience meets the requirement for designation?

1—5 hours.
2—8 hours.
3—10 hours.

**5372.** A person is designated pilot in command of a multiengine, turboprop-powered airplane operated in passenger-carrying service by a commuter air carrier. If eight takeoffs and landings are accomplished in that make and basic model, which additional pilot-in-command experience meets the requirement for designation?

1—7 hours.
2—5 hours, and two takeoffs and landings.
3—10 hours, and two takeoffs and landings.

**5373.** What instrument time experience must a pilot have had to act as second in command of an airplane for an IFR air taxi flight?

1—6 hours of actual or simulated instrument flight time within the preceding 6 months.
2—3 hours of instrument flight time under actual or simulated instrument flight conditions within the preceding 6 months.
3—3 hours of actual or simulated instrument flight time within the preceding 90 days.

**5374.** To satisfy the instrument approach recency experience requirement, a second in command must have made at least

1—six approaches within the past 6 months; three must have been in the category aircraft to be flown.
2—six approaches within the past 6 months in any airplane, helicopter, approved instrument ground trainer, or simulator.
3—three approaches within the past 90 days in an airplane, helicopter, approved instrument ground trainer, or simulator.

**5375.** Pilot flight time limitations under FAR Part 135 are based

1—on the flight time accumulated under FAR Part 135 and in any other commercial flying.
2—solely on flight time accumulated in air taxi operations.
3—solely on flight time accumulated under FAR Part 135 and FAR Part 121.

**5376.** A person may not serve as pilot in any operation unless that person has passed

1—a competency check within 180 days prior to the date to serve.
2—an aircraft proficiency check since the beginning of the 6th calendar month prior to the date to serve.
3—a competency check since the beginning of the 12th calendar month prior to the date to serve.

**5377.** A pilot in command who is authorized to use an autopilot system in place of a second in command, may take the autopilot check

1—concurrently with the instrument proficiency check, but at 1-month intervals.
2—in any aircraft appropriately equipped, providing the check is taken at 3-month intervals.
3—concurrently with the competency check, providing the check is taken at 6-month intervals.

**5378.** A person may not serve as pilot in command in an IFR operation unless that person has passed an

1—aircraft competency and an instrument proficiency check within the previous 18 calendar months.
2—instrument proficiency check in the airplane in which to serve, or in an approved aircraft simulator, within the previous 12 calendar months.
3—instrument proficiency check under actual or simulated IFR conditions, since the beginning of the 6th calendar month prior to the date to serve.

**5379.** A person is assigned as pilot in command to fly both single-engine and multiengine airplanes and has passed the initial instrument proficiency check in a multiengine airplane. Which requirement applies regarding each succeeding instrument check?

1—The instrument check must be taken each 6 calendar months in both a single-engine and a multiengine airplane.
2—The instrument check must be taken alternately in single-engine and multiengine airplanes.
3—The instrument check may be taken in either a single-engine or multiengine airplane if taken at intervals of 3 calendar months.

**5380.** A pilot in command is authorized to use an autopilot system in place of a second in command. During the instrument proficiency check, that person is required to demonstrate the ability to

1—properly conduct instrument operations competently both with, and without, the autopilot.
2—properly conduct air-ground communications with, but not without, the autopilot.
3—comply with complex air traffic control instructions with, but not without, the autopilot.

**5381.** A person may act as pilot in command of both type A and type B aircraft under IFR if an instrument proficiency check has been passed in

1—type A since the beginning of the 12th month, and in type B since the beginning of the 6th month before time to serve.
2—either type A or B since the beginning of the 24th month before time to serve.
3—type A since the beginning of the 12th month, and in type B since the beginning of the 24th month before time to serve.

**5382.** No certificate holder may use a person as pilot in command unless that person has passed a line check

1—within the past 180 days.
2—since the beginning of the 6th month before serving as pilot in command.
3—since the beginning of the 12th month before serving as pilot in command.

**5383.** What are the minimum requirements for the line check required of each pilot in command authorized for IFR air taxi operations? The line check shall be given over

1—one route segment in each type of airplane the pilot is to fly and includes takeoffs and landings at each airport on the route.
2—a civil airway or an approved off-airway route in one type of airplane the pilot is to fly and includes takeoffs and landings at one or more representative airports.
3—a civil airway or an approved off-airway route in each make and model airplane the pilot is to fly and includes instrument approaches at each designated airport on the route.

**5384.** To serve as pilot in command in an IFR operation, a person must have passed a line check

1—since the beginning of the 12th month before that service, which included at least one flight over a civil airway, or approved off-airway route, or any portion of either.
2—consisting of a flight over the route to be flown, with at least three instrument approaches at representative airports, within the past 12 calendar months.
3—within the past 12 months, which include a portion of a civil airway and one instrument approach at one representative airport.

**5385.** Which takeoff computation must not exceed the length of the runway plus the length of the stopway for a turbine-engine-powered small transport category airplane?

1—Takeoff distance.
2—Acceleration-stop distance.
3—Takeoff run.

**5386.** The effective length of the most favorable runway at a certain airport is 8,600 feet. The maximum landing distance permitted for a large transport category turbopropeller-powered airplane to list this airport as an alternate is

1—6,020 feet.
2—6,880 feet.
3—7,740 feet.

**5387.** What is the maximum landing distance for a turbojet small transport category airplane if the effective length of the most favorable runway of the airport to be used as an alternate is 8,000 feet?

1—6,400 feet.
2—5,600 feet.
3—4,800 feet.

**5388.** What is the maximum landing distance for a turbine-engine-powered small transport category airplane if the effective length of the most favorable runway of the destination airport is 7,000 feet?

1—4,200 feet.
2—4,900 feet.
3—5,600 feet.

**5389.** If a certificate holder makes arrangements for another person to perform aircraft maintenance, that maintenance shall be performed in accordance with the

1—certificate holder's manual and FAR Parts 43, 91, and 135.
2—provisions of a contract prepared by a certificate holder and approved by the supervising FAA district office.
3—provisions and standards outlined in the certificate holder's aircraft maintenance handbook.

**5390.** Who is responsible for submitting a Mechanical Reliability Report?

1—Air carrier and commercial operator certificate holders.
2—Maintenance facility that discovers a reportable condition.
3—Aircraft maintenance inspector at district office that exercises surveillance.

**5391.** If not excepted, what label, if any, must be placed on a package containing acetone? (See appendix 2.)

1—No label is required.
2—POISON.
3—FLAMMABLE LIQUID.

**5392.** What is the maximum, if any, net quantity of acetyl bromide in one package, that may be carried in a cargo-only aircraft? (See appendix 2.)

1—1 quart.
2—1 gallon.
3—No limit is specified.

**5393.** What is the maximum, if any, net quantity of acetylene in one package, that may be carried in a passenger-carrying aircraft? (See appendix 2.)

1—Any amount is forbidden.
2—300 pounds.
3—No limit is specified.

**5394.** If not excepted, what label, if any, must be placed on a package containing allethrin? (See appendix 2.)

1—ORM-A.
2—None.
3—CORROSIVE.

**5395.** What is the maximum, if any, net quantity of aluminum hydride in one package, that may be carried in a passenger-carrying aircraft? (See appendix 2.)

1—No limit is specified.
2—25 pounds.
3—Any amount is forbidden.

**5396.** Hazardous material shipped in an aircraft operated under FAR Part 135 must be described and certified on a shipping paper. For what period of time must the originating aircraft operator retain one copy of this document? (See appendix 2, Excerpt from CFR 49, Part 175.)

1—30 days.
2—60 days.
3—90 days.

**5397.** Certain classes of hazardous material may be shipped by air but are not permitted aboard passenger-carrying aircraft. How must such material be labeled? (See appendix 2, Excerpt from CFR 49, Part 175.)

1—DANGEROUS.
2—HAZARDOUS/CLASS X.
3—CARGO AIRCRAFT ONLY.

**5398.** The aircraft operator discovers that the label on a container of hazardous material is missing. How should the appropriate replacement label be determined? (See appendix 2, Excerpt from CFR 49, Part 175.)

1—Shipping papers.
2—Hazardous material index.
3—Hazardous materials table of CFR 49.

**5399.** An operator makes a telephone report of an incident involving fire during the loading of hazardous materials. Within what period of time must a written report be submitted? (See appendix 2, Excerpt from CFR 49, Part 175.)

1—48 hours.
2—10 days.
3—15 days.

**5400.** Which procedure must be followed if an operator, when loading magnetized material, cannot avoid placing it in a position where it affects the accuracy of the magnetic compass? (See appendix 2, Excerpt from CFR 49, Part 175.)

1—Placard the compass "unreliable."
2—Rely solely on electronic navigation.
3—Make a special compass swing and calibration.

**5401.** Which class of hazardous material must be loaded aboard an aircraft in a position that allows no contact with containers of corrosive materials? (See appendix 2, Excerpt from CFR 49, Part 175.)

1—Organic chemicals.
2—Oxidizing materials.
3—Catalytic agents.

**5402.** What is the maximum weight of hazardous material (other than nonflammable compressed gas) that may be carried in an accessible cargo compartment of a passenger-carrying aircraft? (See appendix 2, Excerpt from CFR 49, Part 175.)

1—50 pounds, unless otherwise specifically permitted.
2—10 pounds, if classified as corrosive.
3—25 pounds, if classified as ORM-D.

**5403.** What is the maximum, if any, number of packages of ORM material that may be transported in a passenger-carrying aircraft? (See appendix 2, Excerpt from CFR 49, Part 175.)

1—No limit applies
2—A number whose combined transportation indices total 50.
3—A number whose combined transportation indices total 100.

**5404.** If transported in a passenger-carrying aircraft, what is the maximum combined transportation indices of packages containing radioactive materials? (See appendix 2, Excerpt from CFR 49, Part 175.)

1—100.
2—50.
3—25.

**5405.** What is the maximum quantity of flammable liquid fuel that may be carried in the cabin of a small, nonscheduled, passenger-carrying aircraft being operated in a remote area of the United States? (See appendix 2, Excerpt from CFR 49, Part 175.)

1—10 gallons.
2—15 gallons.
3—20 gallons.

**5406.** What is the minimum distance that a package of radioactive materials bearing the label "RADIOACTIVE YELLOW II," and having a transport index of 15, may be placed from a space continuously occupied by people? (See appendix 2, Excerpt from CFR 49, Part 175.)

1—3 feet.
2—4 feet.
3—5 feet.

**5407.** Who should be notified if there is a suspected radioactive contamination involving a radioactive materials shipment and it is determined that radiological advice is needed? (See appendix 2, Excerpt from CFR 49, Part 175.)

1—Office of Hazardous Materials Regulation.
2—U.S. Energy Research and Development Administration.
3—Nuclear Regulatory Commission.

**5408.** What precaution, if any, should be taken if dry ice is carried aboard an aircraft?

1—This material does not require special precautions.
2—A waiver to carry this material should be requested from the certificating FAA district office.
3—Proper ventilation of the aircraft should be assured.

**5409.** How can turbulent air cause an increase in stalling speed of an airfoil?

1—An abrupt change in relative wind.
2—A decrease in angle of attack.
3—Sudden decrease in load factor.

**5410.** What effect does an increase in airspeed have on a coordinated turn while maintaining a constant angle of bank and altitude?

1—The rate of turn will decrease resulting in a decreased load factor.
2—The rate of turn will increase resulting in an increased load factor.
3—The rate of turn will decrease resulting in no changes in load factor.

**5411.** What is the effect on total drag of an aircraft if the airspeed decreases in level flight below that speed for maximum L/D?

1—Drag increases because of increased induced drag.
2—Drag increases because of increased parasite drag.
3—Drag decreases because of lower induced drag.

**5412.** What is load factor?

1—Lift multiplied by the total weight.
2—Lift subtracted from the total weight.
3—Lift divided by the total weight.

**5413.** For a given angle of bank, the load factor imposed on both the aircraft and pilot in a coordinated constant altitude turn

1—is directly related to the airplane's gross weight.
2—varies with the rate of turn.
3—is constant.

**5414.** What is the ratio between the total air load imposed on the rotor disc and the gross weight of a helicopter in flight?

1—Power loading.
2—Load factor.
3—Aspect ratio.

**5415.** If an aircraft with a gross weight of 2,000 pounds were subjected to a total load of 6,000 pounds in flight, the load factor would be

1—2 G's.
2—3 G's.
3—9 G's.

**5416.** What does wing loading during a level coordinated turn in smooth air depend upon?

1—Rate of turn.
2—Angle of bank.
3—True airspeed.

**5417.** What is the relationship of the rate of turn with the radius of turn with a constant angle of bank but increasing airspeed?

1—Rate will decrease and radius will increase.
2—Rate will increase and radius will decrease.
3—Rate and radius will increase.

**5418.** How can the pilot increase the rate of turn and decrease the radius at the same time?

1—Steepen the bank and increase airspeed.
2—Steepen the bank and decrease airspeed.
3—Shallow the bank and increase airspeed.

**5419.** Why must the angle of attack be increased during a turn to maintain altitude?

1—Compensate for loss of vertical component of lift.
2—Increase the horizontal component of lift equal to the vertical component.
3—Compensate for increase in drag.

**5420.** If no corrective action is taken by the pilot as angle of bank is increased, how is the vertical component of lift and sink rate affected?

1—Lift increases and the sink rate increases.
2—Lift decreases and the sink rate decreases.
3—Lift decreases and the sink rate increases.

**5421.** What affects indicated stall speed?

1—Weight, load factor, and power.
2—Load factor, angle of attack, and power.
3—Angle of attack, weight, and air density.

**5422.** In a light twin-engine airplane with one engine inoperative, when is it acceptable to allow the ball of a slip-skid indicator to be deflected outside the reference lines?

1—While maneuvering at minimum controllable airspeed to avoid overbanking.
2—When operating at any airspeed greater than $V_{MC}$.
3—When practicing imminent stalls in a banked attitude.

**5423.** What is the safest and most efficient takeoff and initial climb procedure in a light twin-engine airplane? Accelerate to

1—best engine-out, rate-of-climb airspeed while on the ground, then lift off and climb at that speed.
2—$V_{MC}$, then lift off at that speed and climb at maximum angle-of-climb airspeed.
3—an airspeed slightly above $V_{MC}$, then lift off and climb at the best rate-of-climb airspeed.

**5424.** What procedure is recommended for an engine-out approach and landing?

1—The flightpath and procedures should be almost identical to a normal approach and landing.
2—The altitude and airspeed should be considerably higher than normal throughout the approach.
3—A normal approach, except do not extend the landing gear or flaps until over the runway threshold.

**5425.** What performance should a pilot of a light twin-engine airplane be able to maintain at $V_{MC}$?

1—Heading.
2—Heading and altitude.
3—Heading, altitude, and ability to climb 50 ft/min.

**5426.** What criteria determines which engine is the "critical" engine of a twin-engine airplane?

1—The one with the center of thrust closest to the centerline of the fuselage.
2—The one designated by the manufacturer which develops most usable thrust.
3—The one with the center of thrust farthest from the centerline of the fuselage.

**5427.** What effect, if any, does altitude have on $V_{MC}$ for an airplane with unsupercharged engines?

1—None.
2—Increases with altitude.
3—Decreases with altitude.

**5428.** Under what condition should stalls never be practiced in a twin-engine airplane?

1—With one engine inoperative.
2—With climb power on.
3—With full flaps and gear extended.

**5429.** The blue radial line on the airspeed indicator of a light twin-engine airplane represents

1—maximum single-engine rate of climb.
2—maximum single-engine angle of climb.
3—minimum controllable airspeed for single-engine operation.

**5430.** Under what condition is $V_{MC}$ the highest?

1—Gross weight is at the maximum allowable value.
2—CG is at the most rearward allowable position.
3—CG is at the most forward allowable position.

**5431.** What action should be taken if one engine of a light twin-engine airplane becomes inoperative prior to lift-off during takeoff?

1—Accelerate to $V_{YSE}$ before lift-off.
2—Accelerate to $V_{XSE}$ before lift-off.
3—Close both throttles and abandon the takeoff.

**5432.** What is the resulting performance loss when one engine on a twin-engine fails?

1—Reduction of cruise airspeed by 50 percent.
2—Reduction of climb by 50 percent or more.
3—Reduction of all performance by 50 percent.

**5433.** When an engine fails after takeoff, what technique will provide the best climb performance? Wings banked approximately 5° toward the

1—inoperative engine and the ball centered.
2—operating engine and the ball centered.
3—operating engine and ball displaced one diameter toward the operating engine.

**5434.** If an engine failure occurs at an altitude above single-engine ceiling, what airspeed should be maintained?

1—$V_{MC}$.
2—$V_{YSE}$.
3—$V_{XSE}$.

**5435.** What is the reason for variations in geometric pitch (twisting) along a propeller or rotor blade?

1—It permits a relatively constant angle of attack along its length when in cruising flight.
2—It prevents the portion of the blade near the hub or root from stalling during cruising flight.
3—It permits a relatively constant angle of incidence along its length when in cruising flight.

**5436.** Describe dynamic longitudinal stability.

1—Motion about the longitudinal axis.
2—Motion about the lateral axis.
3—Motion about the vertical axis.

**5437.** What is a characteristic of longitudinal instability?

1—Pitch oscillations becoming progressively greater.
2—Bank oscillations becoming progressively greater.
3—Aircraft constantly tries to pitch down.

**5438.** Identify the type stability if the aircraft attitude remains in the new position after the controls have been neutralized.

1—Negative longitudinal static stability.
2—Neutral longitudinal dynamic stability.
3—Neutral longitudinal static stability.

**5439.** Identify the type stability if the aircraft attitude tends to move farther from its original position after the controls have been neutralized.

1—Negative static stability.
2—Positive static stability.
3—Negative dynamic stability.

**5440.** Identify the type stability if the aircraft attitude tends to return to its original position after the controls have been neutralized.

1—Positive dynamic stability.
2—Positive static stability.
3—Neutral dynamic stability.

**5441.** What effect does landing at high elevation airports have on groundspeed with comparable conditions relative to temperature, wind, and airplane weight?

1—Higher than at low elevation.
2—Lower than at low elevation.
3—The same as at low elevation.

**5442.** What flight condition should be expected when an aircraft leaves ground effect?

1—An increase in induced drag requiring a higher angle of attack.
2—A decrease in parasite drag permitting a lower angle of attack.
3—An increase in dynamic stability.

**5443.** What characteristic should exist if an airplane is loaded to the rear of its CG range?

1—Sluggish in aileron control.
2—Sluggish in rudder control.
3—Unstable about the lateral axis.

**5444.** What will be the ratio between airspeed and lift if the angle of attack and other factors remain constant and airspeed is doubled? Lift will be

1—the same.
2—two times greater.
3—four times greater.

**5445.** What true airspeed and angle of attack should be used to generate the same amount of lift as altitude is increased?

1—The same true airspeed and angle of attack.
2—A higher true airspeed for any given angle of attack.
3—A lower true airspeed and higher angle of attack.

**5446.** How can an airplane produce the same lift in ground effect as when out of ground effect?

1—The same angle of attack.
2—A lower angle of attack.
3—A higher angle of attack.

**5447.** What performance is characteristic of flight at maximum L/D in a propeller-driven airplane?

1—Maximum range and distance glide.
2—Best angle of climb.
3—Maximum endurance.

**5448.** On an airfoil, the force of lift acts perpendicular to and the force of drag acts parallel to the

1—chord line.
2—flightpath.
3—longitudinal axis.

**5449.** By changing the angle of attack of a wing, the pilot can control the airplane's

1—lift, gross weight, and drag.
2—lift, airspeed, and drag.
3—lift and airspeed, but not drag.

**5450.** Which maximum range factor decreases as weight decreases?

1—Angle of attack.
2—Altitude.
3—Airspeed.

**5451.** What are some characteristics of an airplane loaded with the CG at the aft limit?

1—Lowest stall speed, highest cruise speed, and least stability.
2—Highest stall speed, highest cruise speed, and least stability.
3—Lowest stall speed, lowest cruise speed, and highest stability.

**5452.** The lift differential that exists between the advancing main rotor blade and the retreating main rotor blade is known as

1—Coriolis effect.
2—dissymmetry of lift.
3—translating tendency.

**5453.** During a hover, a helicopter tends to drift in the direction of tail rotor thrust. What is this movement called?

1—Translating tendency.
2—Transverse flow effect.
3—Gyroscopic precession.

**5454.** What is the purpose of the lead-lag (drag) hinge in a three-bladed, fully articulated helicopter rotor system?

1—Offset lateral instability during autorotation.
2—Compensate for Coriolis effect.
3—Provide geometric balance.

**5455.** During an autorotation (collective pitch full down), what is an increase in rotor RPM associated with?

1—An increase in airflow through the rotor system.
2—A decrease in airflow through the rotor system.
3—A decrease in airspeed.

**5456.** What causes Coriolis effect?

1—Differential thrust of rotor blades.
2—Changing angle of attack of blades during rotation.
3—Shift in center of mass of flapping blade.

**5457.** Why are the rotor blades more efficient when operating in ground effect?

1—Induced drag is reduced.
2—Induced angle of attack is increased.
3—Downwash velocity is accelerated.

**5458.** What result does a level turn have on the total lift force and load factor?

1—Lift force remains constant and the load factor increases.
2—Lift force increases and the load factor decreases.
3—Both total lift force and load factor increase.

**5459.** What causes a helicopter to turn?

1—Centrifugal force.
2—Horizontal component of lift.
3—Greater angle of attack of rotor blades on upward side of the rotor disc.

**5460.** What is the primary purpose of the tail rotor system?

1—Maintain heading during forward flight.
2—Act as a rudder to assist in coordinated turns.
3—Counteract the torque effect of the main rotor.

**5461.** Under what condition would it be necessary to cause the tail rotor to direct thrust to the left on an American-made helicopter?

1—To maintain heading with a left crosswind.
2—To counteract the drag of the transmission during autorotation.
3—To execute hovering turns to the right.

**5462.** What is the primary purpose of the free-wheeling unit?

1—To provide speed reduction between the engine, main rotor system, and tail rotor system.
2—To provide disengagement of the engine from the rotor system for autorotation purposes.
3—To transmit engine power to the main rotor, tail rotor, generator/alternator, and other accessories.

**5463.** The main rotor blades of a fully articulated rotor system can

1—flap, drag, and feather collectively.
2—flap, drag, and feather independently of each other.
3—flap and drag individually, but can only feather collectively.

**5464.** The main rotor blades of a semi-rigid system can

1—flap and feather as a unit.
2—flap, drag, and feather independently.
3—flap and drag individually, but can only feather collectively.

**5465.** What is the result of loading a helicopter so that the CG is aft of the rearward limit?

1—Insufficient aft cyclic control to decelerate properly during an approach.
2—Inability of the pilot to recognize this dangerous condition when hovering in a strong headwind.
3—Insufficient forward cyclic control to fly in the upper allowable airspeed range.

**5466.** How is helicopter climb performance most adversely affected?

1—Higher-than-standard temperature and high relative humidity.
2—Lower-than-standard temperature and high relative humidity.
3—Higher-than-standard temperature and low relative humidity.

**5467.** How does high density altitude affect helicopter performance?

1—Engine and rotor efficiency is increased.
2—Engine and rotor efficiency is reduced.
3—Engine efficiency is reduced, but rotor efficiency is increased.

**5468.** What type frequency vibration is indicative of a defective tail rotor system?

1—Low frequency.
2—Medium frequency.
3—High frequency.

**5469.** What type frequency vibration is associated with the main rotor system?

1—Low frequency.
2—Medium frequency.
3—High frequency.

**5470.** What type frequency vibration is associated with a defective transmission?

1—Low frequency.
2—Medium frequency.
3—High frequency.

**5471.** Which is a major warning of approaching retreating blade stall?

1—High frequency vibration.
2—Tendency to roll opposite the stalled side of the rotor.
3—Pitchup of the nose.

**5472.** What corrective action can a pilot take to prevent a retreating blade stall at its onset?

1—Reduce collective pitch and increase rotor RPM.
2—Increase collective pitch and increase rotor RPM.
3—Reduce collective pitch and decrease rotor RPM.

**5473.** Which type rotor system is more susceptible to ground resonance?

1—Fully articulated rotor system.
2—Semi-rigid rotor system.
3—Rigid rotor system.

**5474.** What corrective action can a pilot take to recover from settling with power?

1—Increase forward speed and raise collective pitch.
2—Decrease forward speed and partially raise collective pitch.
3—Increase forward speed and partially lower collective pitch.

**5475.** What limits the high airspeed potential of a helicopter?

1—Harmonic resonance.
2—Retreating blade stall.
3—Rotor RPM limitations.

**5476.** How does $V_{NE}$ speed vary with altitude?

1—Varies directly with altitude.
2—Remains the same at all altitudes.
3—Varies inversely with altitude.

**5477.** How should a quick stop be initiated?

1—Raise collective pitch.
2—Apply aft cyclic.
3—Decrease RPM while raising collective pitch.

**5478.** How should the pilot execute a pinnacle-type approach to a rooftop heliport in conditions of high wind and turbulence?

1—Steeper than normal approach, maintaining the desired angle of descent with collective.
2—Normal approach, maintaining a slower-than-normal rate of descent with cyclic.
3—Shallow approach, maintaining a constant line of descent with cyclic.

**5479.** The primary purpose of high-lift devices is to increase the

1—$L/D_{max}$.
2—lift at low speeds.
3—drag and reduce airspeed.

**5480.** What is the primary function of the leading edge flaps in landing configuration during the flare before touchdown?

1—Prevent flow separation.
2—Decrease rate of sink.
3—Increase profile drag.

**5481.** What effect does the leading edge slot in the wing have on performance?

1—Decrease profile drag.
2—Changes the stalling angle of attack to a higher angle.
3—Decelerates the upper surface boundary layer air.

**5482.** Within what Mach range does transonic flight regimes usually occur?

1—.50 to .75 Mach.
2—.75 to 1.20 Mach.
3—1.20 to 2.50 Mach.

**5483.** What is the highest speed possible without supersonic flow over the wing?

1—Initial buffet speed.
2—Critical Mach number.
3—Transonic index.

**5484.** What is the free stream Mach number which produces first evidence of local sonic flow?

1—Supersonic Mach number.
2—Transonic Mach number.
3—Critical Mach number.

**5485.** At what Mach range does the subsonic flight range normally occur?

1—Below .75 Mach.
2—From .75 to 1.20 Mach.
3—From 1.20 to 2.50 Mach.

**5486.** What is the principal advantage of a sweepback design wing over a straightwing design?

1—The critical Mach number will increase significantly.
2—Sweepback will increase changes in the magnitude of force coefficients due to compressibility.
3—Sweepback will accelerate the onset of compressibility effect.

**5487.** What is the result of a shock-induced separation of airflow occurring symmetrically near the wing root of a sweptwing aircraft?

1—A high-speed stall and sudden pitchup.
2—A severe moment or "tuck under."
3—Severe porpoising.

**5488.** What is one disadvantage of a sweptwing design?

1—The wing root stalls prior to the wingtip section.
2—The wingtip section stalls prior to the wing root.
3—Severe pitch down moment when the center of pressure shifts forward.

**5489.** What is the condition known as when gusts cause a sweptwing-type airplane to roll in one direction while yawing in the other?

1—Porpoise.
2—Wingover.
3—Dutch roll.

**5490.** What is the movement of the center of pressure when the wingtips of a sweptwing airplane are shock-stalled first?

1—Inward and aft.
2—Inward and forward.
3—Outward and forward.

**5491.** What is critical Mach number?

1—The highest flight speed possible without supersonic flow.
2—The speed at which the forward shift of center of pressure causes a severe pitch down.
3—The speed at which the airflow over the wing first reaches the speed of sound.

**5492.** What equipment on a sweptwing airplane contributes to the control of a dutch roll?

1—Rudder lock.
2—Yaw damper.
3—Rudder trim.

**5493.** Aircraft equipped with both high-speed and low-speed ailerons will use the outboard ailerons only during

1—low-speed operations.
2—high-speed operations.
3—low-altitude operations.

**5494.** (Refer to figures 1, 2, and 5.) What is the ETE at .80 Mach?

1—43 minutes.
2—45 minutes.
3—47 minutes.

**5495.** (Refer to figures 1, 2, and 5.) What is the total fuel required at .80 Mach?

1—9,700 pounds.
2—15,550 pounds.
3—16,750 pounds.

**5496.** (Refer to figures 1, 2, and 5.) What approximate indicated Mach should be maintained to arrive over the BLH VORTAC 9 minutes after passing TRM VORTAC?

1—.73 Mach.
2—.74 Mach.
3—.75 Mach.

**5497.** (Refer to figures 1 and 5.) What approximate indicated Mach should be maintained to arrive over the SALOM Intersection 5 minutes after passing BLH VORTAC?

1—.85 Mach.
2—.86 Mach.
3—.87 Mach.

**5498.** (Refer to figures 1 and 5.) What is the specific range in nautical miles per 1,000 pounds of fuel from TRM VORTAC to the SALOM Intersection using .76 Mach?

1—42 NAM/1,000 pounds.
2—43 NAM/1,000 pounds.
3—44 NAM/1,000 pounds.

**5499.** (Refer to figures 1, 2, and 5.) What is the ETE at .78 Mach?

1—46 minutes.
2—48 minutes.
3—50 minutes.

**5500.** (Refer to figures 1, 2, and 5.) What is the total fuel required at .78 Mach?

1—15,620 pounds.
2—16,820 pounds.
3—17,250 pounds.

**5501.** (Refer to figures 1, 2, and 5.) What is the ETE at .82 Mach?

1—43 minutes.
2—45 minutes.
3—47 minutes.

**5502.** (Refer to figures 1, 2, and 5.) What is the total fuel required at .82 Mach?

1—15,434 pounds.
2—15,484 pounds.
3—16,750 pounds.

**5503.** (Refer to figures 1, 2, and 5.) What approximate indicated Mach should be maintained to arrive over the BLH VORTAC 8 minutes after passing TRM VORTAC?

1—.84 Mach.
2—.85 Mach.
3—.86 Mach.

**5504.** (Refer to figures 1, 2, and 5.) What is the specific range in nautical miles per 1,000 pounds of fuel from level-off to the SALOM Intersection using .78 Mach?

1—42 NAM/1,000 pounds.
2—43 NAM/1,000 pounds.
3—44 NAM/1,000 pounds.

**5505.** (Refer to figures 1 and 2.) Immediately after takeoff on Rwy 25, communications fail. What action should the pilot take?

1—Abort the departure and return to the airport.
2—Continue the flight according to the clearance.
3—Continue to the nearest suitable airport and land.

**5506.** (Refer to figures 1 and 2.) Define the departure route from a takeoff on Rwy 25 to the en route phase according to the flight plan.

1—Direct VTU VORTAC, then via VTU R-114 to FLIPR INT., via SLI R-220 to SLI, via SLI R-060 to CHANGEOVER PT., via V64 TRM.
2—Rwy heading to VTU VORTAC, then via VTU R-114 to FLIPR INT., via 066 BRN from MAAGG LMM to intercept and maintain V64 to TRM VORTAC.
3—Rwy heading to LAX VORTAC, turn left heading 220° to intercept VTU R-114 to FLIPR INT., via 066 BRN to MAAGG LMM, via 060 BRN from MAAGG LMM to intercept and maintain V64 to TRM VORTAC.

**5507.** (Refer to figures 1 and 2.) What frequency should be monitored during departure from LAX?

1—125.2 or 385.4 MHz.
2—120.95 or 379.1 MHz.
3—124.3 MHz.

**5508.** (Refer to figure 3.) During the arrival phase at Phoenix Sky Harbor Intl., what radio frequency will provide weather and airport conditions?

1—121.2 MHz.
2—122.0 MHz.
3—124.1 MHz.

**5509.** (Refer to figure 4.) The minimum weather condition to clear a flight for the POWER PLANT VISUAL RWY 26L approach is

1—1,000/3.
2—4,000/3.
3—4,000/8.

**5510.** (Refer to figure 4.) What are the minimum conditions for the base leg for the POWER PLANT VISUAL RWY 26L approach?

1—4,000 feet and remain on or east of the SRP R-170.
2—3,100 feet and remain on or west of the SRP R-170.
3—3,100 feet and remain on or east of the SRP R-170.

**5511.** (Refer to figure 4.) The POWER PLANT VISUAL RWY 26L approach normally begins

1—15 flying miles from the airport.
2—opposite South Mountain.
3—at ARLIN INT.

**5512.** (Refer to to figure 4.) ATC may clear the flight for the POWER PLANT VISUAL RWY 26L only in radar environment and only

1—if the pilot agrees to cancel the IFR flight plan and proceed VFR.
2—after the pilot reports citing a charted landmark or a preceding aircraft.
3—if the approach is requested by the pilot.

**5513.** (Refer to figure 4.) Why are charted visual flight procedures, such as the POWER PLANT VISUAL RWY 26L, established?

1—For noise abatement purposes at locations with jet operations.
2—To sequence landing aircraft and enable IFR approaches to have priority.
3—To allow pilots to request the VFR approaches in lieu of IFR approaches.

**5514.** (Refer to figure 3.) Straight in minimums for a Category B aircraft equipped with DME on the LOC BC RWY 26L approach are

1—1,800/1.
2—700/1.
3—1,540/1.

**5515.** (Refer to figure 3.) How is course reversal accomplished when outbound on the LOC BC RWY 26L approach at Phoenix Sky Harbor Intl.?

1—Radar vector only.
2—Procedure turn beyond 10 NM.
3—Holding pattern entry beyond 10 NM.

**5516.** (Refer to figure 3.) What instrument approach light system, if any, is available for the LOC BC RWY 26L approach at Phoenix Sky Harbor Intl.?

1—None.
2—HIRL.
3—REIL.

**5517.** (Refer to figure 3.) Identify the final approach fix on the LOC BC RWY 26L approach at Phoenix Sky Harbor Intl.

1—Upon intercepting the glide slope beyond I-PHX 5 DME.
2—When crossing I-PHX 5 DME at 3,000 feet.
3—When crossing the SRP VORTAC on the glide slope.

**5518.** (Refer to figure 3.) The touchdown zone elevation of the LOC BC RWY 26L approach at Phoenix Sky Harbor Intl. is

1—1,132 feet.
2—1,122 feet.
3—1,121 feet.

**5519.** (Refer to figure 3.) When should the pilot expect radar vectors to the final approach course of the LOC BC RWY 26L approach at Phoenix Sky Harbor Intl.?

1—SALOM INT.
2—ARLIN INT.
3—Approximately 25 NM from SRP VORTAC.

**5520.** (Refer to figure 3.) Determine the FAR Part 121 landing minimums for the LOC BC RWY 26L approach at Phoenix Sky Harbor Intl.

PIC time ............................................ 94 hours
Airplane $V_{S0}$ maximum
certificated weight ............................ 105 knots
$V_{REF}$ approach speed ........................ 140 knots
DME NOTAMed OTS

1—1,800/2.
2—1,900/2-1/4.
3—1,900/2-1/2.

**5521.** (Refer to figure 3.) Determine the FAR Part 135 landing minimums for turbine powered aircraft on the LOC BC RWY 26L approach at Phoenix Sky Harbor Intl.

PIC time ............................................ 98 hours
Airplane $V_{S0}$ maximum
certificated weight ............................ 103 knots
$V_{REF}$ approach speed ........................ 126 knots
DME NOTAMed OTS

1—1,800/2.
2—1,900/2-1/4.
3—1,900/2-1/2.

**5522.** (Refer to figure 3.) What is the HAT a Category B aircraft may descend to if the pilot has identified HADEN INT on the LOC BC RWY 26L approach at Phoenix Sky Harbor Intl.?

1—418 feet.
2—500 feet.
3—670 feet.

**5523.** (Refer to figures 6 and 7.) If communications are lost soon after takeoff on Rwy 11R at Tucson Intl., what altitude restrictions apply?

1—Maintain 17,000 feet to GBN, then climb to assigned altitude.
2—Climb in holding pattern (NW, right turn, 128 inbound) to 9,000, then on course to 17,000 feet or lower assigned altitude.
3—Remain at or below 9,000 feet to ROSKR INT, then climb to and maintain 17,000 feet to GBN.

**5524.** (Refer to figure 7.) What are the takeoff minimums for Rwy 11R at Tucson Intl.?

1—1 SM.
2—800/1.
3—4,000/3.

**5525.** (Refer to figure 7.) Determine the DEP CON frequency for the TUS2.GBN SID after takeoff from Rwy 11R at Tucson Intl.

1—125.1 MHz.
2—118.5 MHz.
3—119.0 MHz.

**5526.** (Refer to figures 6 and 7.) Using an average groundspeed of 140 knots, what minimum indicated rate of climb must be maintained to meet the required climb rate (feet per NM) to 9,000 as specified on the SID?

1—349 ft/min.
2—560 ft/min.
3—584 ft/min.

**5527.** (Refer to figure 6.) What CAS should be used to maintain the fixed TAS at the proposed altitude?

1—157 knots.
2—167 knots.
3—172 knots.

**5528.** (Refer to figure 7.) How can the pilot receive the latest NOTAM's for the TUS-LAX flight?

1—Monitor ATIS on 123.8 MHz.
2—Contact the FSS on 122.2 MHz.
3—Request ADCUS on any FSS or Tower frequency.

**5529.** (Refer to figure 7.) What distance is available for takeoff on Rwy 11R at Tucson Intl.?

1—7,000 feet.
2—9,129 feet.
3—10,994 feet.

**5530.** (Refer to figure 7.) What effect on the takeoff run can be expected on Rwy 11R at Tucson Intl.?

1—Takeoff length shortened to 6,986 feet by displaced threshold.
2—Takeoff run shortened by 0.6 percent runway slope to the SE.
3—Takeoff run will be lengthened by the 0.6 percent upslope of the runway.

**5531.** (Refer to figures 5, 6, 7, and 8.) Determine the ETE for the flight from Tucson Intl. to Los Angeles Intl.

1—2 hours 10 minutes.
2—2 hours 15 minutes.
3—2 hours 19 minutes.

**5532.** (Refer to figures 5, 6, 7, and 8.) Estimate the total fuel required (including missed approach) from Tucson Intl. to Los Angeles Intl.

1—2,048 pounds.
2—2,098 pounds.
3—2,218 pounds.

**5533.** (Refer to figures 5 and 6.) What TAS would be required to arrive at the start descent position 24 minutes after passing TNP?

1—248 knots.
2—251 knots.
3—254 knots.

**5534.** (Refer to figures 5 and 6.) What TAS would be required to arrive at the intersection of J104 20 minutes after passing GBN?

1—266 knots.
2—269 knots.
3—272 knots.

**5535.** (Refer to figures 2 and 8.) Which approach control frequency is indicated for the TPN.DOWNE2 Arrival with LAX as the destination?

1—128.5 MHz.
2—124.9 MHz.
3—124.5 MHz.

**5536.** (Refer to figure 9.) At what point does the flight enter the final approach phase of the ILS RWY 25L at LAX?

1—FUELR INT.
2—HUNDA INT.
3—Intercept of glide slope.

**5537.** (Refer to figure 9.) What is the DH for the ILS RWY 25L at LAX if the pilot has completed the initial Category II certification within the preceding 6 months?

1—201 feet.
2—251 feet.
3—301 feet.

**5538.** (Refer to figure 9.) The radio altimeter indication for the DH at the inner marker on the ILS RWY 25L approach at LAX is

1—101.
2—111.
3—201.

**5539.** (Refer to figure 9) The 7,000-foot marker at BASET INT on the ILS RWY 25L approach at LAX is the

1—maximum altitude at BASET INT.
2—minimum altitude at BASET INT.
3—minimum altitude at BASET INT for pilots approved for the 151 DH.

**5540.** (Refer to figure 9.) If the glide slope indication is lost upon passing HUNDA INT on the ILS RWY 25L approach at LAX, what action should the pilot take?

1—Continue the approach as an LOC and add 100 feet to the DH.
2—Immediately start the missed approach direct to INISH INT.
3—Continue to the MAP and execute the missed approach as indicated.

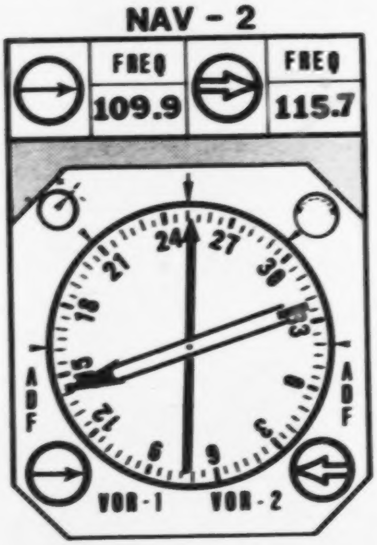
**5541.** (Refer to figure 9.) What approach lights are available for the ILS RWY 25L approach at LAX?

1—ALSF-2 with sequenced flashing lights.
2—MALSR with a displayed threshold.
3—HIRL and TDZ/CL.

**5542.** (Refer to figures 8 and 9.) What is the function of "LR-075 LAX" depicted below FUELR INT and BASET INT on the plan view of ILS RWY 25L at LAX?

1—Limits off-course on the left side of the LOC.
2—Replaces the edge of the LOC indication where it is unreliable.
3—Lead in radial for transition to the LOC course.

**5543.** (Refer to figure 9.) What is the position of the aircraft on the ILS RWY 25L approach at LAX?



1—Right of course just past BASET INT inbound.
2—Left of course approaching DOWNE INT inbound.
3—Left of course just past DOWNE INT inbound.

**5544.** (Refer to figures 10 and 11.) What is the ETE for the IFR Helicopter flight from Baker Airport to LAX?

1—1 hour 33 minutes.
2—1 hour 36 minutes.
3—1 hour 39 minutes.

**5545.** (Refer to figures 10 and 11.) What is the total fuel required for the IFR Helicopter flight from Baker Airport to LAX?

1—3,038 pounds.
2—3,656 pounds.
3—3,703 pounds.

**5546.** (Refer to figures 10 and 11.) What TAS would be required to arrive at POM VORTAC 52 minutes after passing DAG VORTAC?

1—114 knots.
2—117 knots.
3—120 knots.

**5547.** (Refer to figures 10 and 11.) What TAS would be required to arrive at POM VORTAC 1 hour after passing DAG VORTAC?

1—102 knots.
2—105 knots.
3—108 knots.

**5548.** (Refer to figure 11.) The changeover point on V394 between DAG VORTAC and POM VORTAC is

1—halfway.
2—38 DME miles from DAG VORTAC.
3—64 DME miles from DAG VORTAC.

**5549.** (Refer to figure 11.) The minimum crossing altitude at APLES INT southwest bound on V394 is

1—7,500 feet.
2—9,100 feet.
3—11,500 feet.

**5550.** (Refer to figure 11.) What is the minimum crossing altitude at POM VORTAC when southwest bound on V210?

1—10,700 feet.
2—10,300 feet.
3—5,300 feet.

**5551.** (Refer to figure 9.) How can DOWNE INT be identified?

1—ILAX 15 DME.
2—LAX VORTAC 15 DME.
3—LAX VORTAC R-249 and SLI VORTAC R-327.

**5552.** (Refer to figure 2.) How should the IFR flight plan be closed upon landing at LAX?

1—Contact Hawthorne FSS on 123.6 MHz.
2—Phone Hawthorne FSS on 644-1020.
3—LAX tower will close it automatically.

**5553.** (Refer to figure 9.) What tower and ground control frequencies should a helicopter use when operating from the west to the heliport on the SE side of LAX?

| TOWER | GROUND CONTROL |
|---|---|
| 1—119.8 MHz | 121.75 MHz. |
| 2—120.35 MHz | 121.75 MHz. |
| 3—119.8 MHz | 121.65 MHz. |

**5554.** (Refer to figures 12, 13 and 14.) What is the ETE from Greater Buffalo Intl. to Chicago O'Hare Intl. using .80 Mach?

1—1 hour 11 minutes.
2—1 hour 15 minutes.
3—1 hour 17 minutes.

**5555.** (Refer to figures 12, 13, and 14.) Determine the total fuel required for the flight from Greater Buffalo Intl. to Chicago O'Hare Intl. using .80 Mach.

1—15,357 pounds.
2—15,995 pounds.
3—15,645 pounds.

**5556.** (Refer to figures 12 and 14.) What approximate indicated Mach should be maintained to arrive at the start of descent 28 minutes after passing ECK?

1—.85 Mach.
2—.86 Mach.
3—.83 Mach.

**5557.** (Refer to figures 12 and 14.) What is the specific range in nautical air miles per 1,000 pounds of fuel from ECK to start descent using .80 Mach?

1—55 NAM/1,000.
2—56 NAM/1,000.
3—57 NAM/1,000.

**5558.** (Refer to figures 12 and 14.) What is the ETE at .78 Mach?

1—1 hour 12 minutes.
2—1 hour 14 minutes.
3—1 hour 16 minutes.

**5559.** (Refer to figures 12 and 14.) What is the total fuel required at .78 Mach?

1—14,902 pounds.
2—15,537 pounds.
3—16,326 pounds.

**5560.** (Refer to figures 12 and 14.) What approximate indicated Mach should be maintained to arrive at the start of descent 32 minutes after passing ECK?

1—.72 Mach.
2—.73 Mach.
3—.74 Mach.

**5561.** (Refer to figures 12 and 14.) What is the specific range in nautical air miles per 1,000 pounds of fuel from ECK to start descent using .78 Mach?

1—53 NAM/1,000.
2—54 NAM/1,000.
3—55 NAM/1,000.

**5562.** (Refer to figures 12 and 14.) What is the ETE at .76 Mach?

1—1 hour 15 minutes.
2—1 hour 17 minutes.
3—1 hour 19 minutes.

**5563.** (Refer to figures 12 and 14.) What is the total fuel required at .76 Mach?

1—14,702 pounds.
2—15,036 pounds.
3—15,729 pounds.

**5564.** (Refer to figures 12 and 14.) What approximate indicated Mach should be maintained to arrive at the start of descent 34 minutes after passing ECK?

1—.67 Mach.
2—.68 Mach.
3—.69 Mach.

**5565.** (Refer to figures 12 and 14.) What is the specific range in nautical air miles per 1,000 pounds of fuel from ECK to start descent using .76 Mach?

1—51.9 NAM/1.000.
2—52.9 NAM/1,000.
3—53.8 NAM/1,000.

**5566.** (Refer to figures 12 and 14.) What is the lowest MEA for the en route portion from BUF to OBK?

1—10,000 feet.
2—12,000 feet.
3—FL160.

**5567.** (Refer to figure 14 and chart legend.) Identify the ARTCC three letter idents and HA-EFAS frequency for Chicago.

1—ZAU, 135.525 MHz.
2—ORD, 269.9 MHz.
3—OBK, 122.0 MHz.

**5568.** (Refer to figure 14 and chart legend.) For that portion of the flight on HL547, night time begins at

1—sunset.
2—1/2 hour after sunset.
3—1 hour after sunset.

**5569.** (Refer to figures 14 and 17.) Identify the LORAN-C coordinates for Greater Buffalo Intl.

1—116.4 BUF 286.9°, 3.5 NM.
2—42°55'44"N - 78°38'48"W.
3—42°56'26"N - 78°43'57"W.

**5570.** (Refer to figures 14 and 17.) Identify the RNAV coordinates for Greater Buffalo Intl.

1—116.4 BUF 286.9°, 3.5 NM.
2—42°56'44"N - 78°38'48"W.
3—42°56'26"N - 78°43'57"W.

**5571.** (Refer to figures 14, 15, and 16.) What is the ETE from Chicago Midway Airport to Greater Buffalo Intl.?

1—2 hours 21 minutes.
2—2 hours 25 minutes.
3—2 hours 28 minutes.

**5572.** (Refer to figures 14, 15, and 16.) What are the fuel requirements from Chicago Midway Airport to Greater Buffalo Intl.?

1—483 pounds.
2—532 pounds.
3—569 pounds.

**5573.** (Refer to figures 14 and 15.) What TAS should be maintained to arrive over CRL VORTAC 50 minutes after level off?

1—163 knots.
2—165 knots.
3—167 knots.

**5574.** (Refer to figures 14, 15, and 16.) If communications are lost after takeoff on Rwy 13L at Chicago Midway, what action should the pilot take?

1—Circle and land at Chicago Midway.
2—Climb on runway heading to 2,000 feet until 6 DME miles from Midway, then maintain 3,000 to 25 DME from Midway. Climb to FL180 and intercept J146.
3—Climb on runway heading to 1,300 feet, at 4 DME turn east then climb to 2,000 feet until 6 DME miles from Midway. Climb to and maintain 3,000 feet to 25 DME from Midway, then turn and climb to FL180 direct to SBN VORTAC.

**5575.** (Refer to figure 14.) What type airway is HL547 used on the flight from Chicago Midway Airport to Greater Buffalo Intl.?

1—Non-jet High Level Route.
2—Helicopter Preferred Route.
3—Canadian High Level Airway.

**5576.** (Refer to figure 14.) The VOR changeover point between SBN VORTAC and CRL VORTAC on J554 should be

1—BENJO INT.
2—Halfway.
3—ARTCC boundary.

**5577.** (Refer to figure 17.) How can the FAF on the RNAV RWY 32 approach at BUF be identified?

1—The RNAV receiver will indicate 175.1° and 2.5 DME miles from BUF VORTAC.
2—The RNAV receiver will indicate a change from TO to FROM and 0 deflection of the course needle.
3—Two flashes/second on the OM beacon light.

**5578.** (Refer to figure 17.) Which waypoint should be setup on the RNAV receiver after identifying the final approach fix?

1—CYUGA.
2—MAP.
3—GANIS.

**5579.** (Refer to figure 17.) What is the procedure for initiating the missed approach on the RNAV RWY 32 approach at BUF?

1—Select GANIS Waypoint and establish a direct course, climbing to 2,700 feet.
2—Select and maintain R-302 of BUF VORTAC climbing to 2,700 feet.
3—Establish and maintain R-286.9 of BUF VORTAC climbing to 2,700 feet.

**5580.** (Refer to figure 17.) What type entry is appropriate for the missed approach holding pattern on the RNAV RWY 32 approach at BUF?

1—Parallel.
2—Direct.
3—Tear drop.

**5581.** (Refer to figure 18.) A VFR helicopter flight originates at the Pan Am Metroport near the United Nations Complex and is scheduled to JFK Intl. List the appropriate route.

1—West bank of East River to E 34th St. via RESERVOIR ROUTE to JFK Intl.
2—East bank of East River to E 34th St. via RESERVOIR ROUTE to JFK Intl.
3—East bank of East River to Williamsburg Bridge via WILLIAMSBURG and RESERVOIR ROUTES to JFK Intl.

**5582.** (Refer to figure 18.) What is the vertical extent of the TCA along the route from Pan Am Metroport to JFK Intl.?

1—1,500 to 7,000 feet.
2—1,700 to 7,000 feet.
3—Surface to 7,000 feet.

**5583.** (Refer to figure 18.) What is the requested minimum altitude on the CONEY ISLAND ROUTE from Flatbush Ave. to the boundary of JFK Intl.?

1—1,700 feet MSL.
2—2,000 feet AGL.
3—300 feet AGL.

**5584.** (Refer to figure 18.) Under what condition, if any, may a helicopter flight depart JFK Intl. on a Special VFR Clearance?

1—None.
2—Both pilot and helicopter are IFR certificated.
3—Clearance from JFK Intl.

**5585.** (Refer to figure 18.) Helicopters en route to LaGuardia below 1,400 feet should contact the tower on

1—118.7 MHz.
2—122.95 MHz.
3—126.05 MHz.

**5586.** (Refer to figure 18.) What frequency should helicopters monitor when maintaining the HUDSON RIVER ROUTE outside the TCA?

1—123.05 MHz.
2—123.75 MHz.
3—122.9 MHz.

**5587.** (Refer to figures 19, 20, 21, and 23.) What is the ETE from DFW Intl. to landing at IAH?

1—54 minutes.
2—56 minutes.
3—58 minutes.

**5588.** (Refer to figures 19, 20, 21, and 23.) What is the total fuel required from DFW Intl. to landing at IAH?

1—1,205 pounds.
2—1,264 pounds.
3—1,393 pounds.

**5589.** (Refer to figure 19.) Determine the TAS required to arrive at CUGAR, 31 minutes after level-off.

1—242 knots.
2—246 knots.
3—249 knots.

**5590.** (Refer to figure 19.) Determine the TAS required to arrive at CUGAR, 29 minutes after level-off.

1—281 knots.
2—286 knots.
3—291 knots.

**5591.** (Refer to figures 20 and 22.) Which frequency should be selected to check airport conditions and weather prior to departure at DFW Intl.?

1—117.0 MHz.
2—134.9 MHz.
3—135.5 MHz.

**5592.** (Refer to figures 20, 21, and 22.) The frequency change from departure control to ARTCC after departing DFW Intl. for IAH is

1—135.5 to 126.0 MHz.
2—118.55 to 127.95 MHz.
3—127.75 to 127.95 MHz.

**5593.** (Refer to figure 21.) Where is the VOR changeover point on V369 between DFW Intl. and TNV?

1—Ft. Worth/Houston ARTCC boundary.
2—81 NM from DFW Intl.
3—TORNN Intl.

**5594.** (Refer to figure 21 or 22.) What is the magnetic variation at both DFW Intl. and IAH?

1—08 E.
2—0.
3—08 W.

**5595.** (Refer to figures 21 and 23.) How should the pilot identify the position to leave V369 for the BILEE CUGAR4 ARRIVAL?

1—Intercept R-305 of IAH.
2—21 DME miles from TNV.
3—141 DME miles from DFW.

**5596.** (Refer to figure 22 and 23.) In addition to VOR and DME, what electronic equipment is required for the VOR/DME RWY 32R approach at IAH?

1—Altitude alerting system.
2—Standby VOR and DME receivers.
3—VHF communications and transponder equipment.

**5597.** (Refer to figure 23.) The BILEE.CUGAR4 arrival ends

1—at BANTY INT.
2—at IAH VORTAC.
3—when cleared to land.

**5598.** (Refer to figure 23.) What action should the pilot take if communications were lost during the BILEE.CUGAR4 arrival?

1—Proceed direct to IAH VORTAC, then outbound on the IAH R-125 for a procedure turn for final approach.
2—From BANTY INT, proceed to the IAF on the IAH R-290, then continue on the IAH 10 DME Arc to final approach.
3—Proceed direct to IAH VORTAC, then to either IAF or the IAH 10 DME Arc to final approach.

**5599.** (Refer to figure 23.) Which approach lighting is available for Rwy 32R?

1—MALSR with RAIL.
2—HIRL.
3—TDZ and CL.

**5600.** (Refer to figure 23.) What effect on approach minimums, if any, does an inoperative MALSR for an aircraft with an approach speed of 120 knots at IAH?

1—None.
2—Increases RVR to 5,000 feet.
3—Increases RVR to 6,000 feet.

**5601.** (Refer to figure 23.) Under what condition may a pilot make a procedure turn while executing the VOR/DME RWY 32R approach at IAH?

1—Only when cleared by ATC.
2—If not DME equipped.
3—When approaching IAH from GOMER INT.

**5602.** (Refer to figure 23.) While arcing left on the IAH 10 DME Arc, the pilot experiences a left crosswind component. Where should the bearing pointer be referenced relative to the wingtip position to maintain the 10 DME range?

1—On the left wingtip reference.
2—Behind the left wingtip reference.
3—Ahead of the left wingtip reference.

**5603.** Where should the RMI bearing pointer be located relative to the wingtip reference to maintain a constant DME distance in a left-hand arc with a right crosswind component?

1—On the left wingtip reference.
2—Behind the left wingtip reference.
3—Ahead of the left wingtip reference.

**5604.** (Refer to figure 23.) When is the earliest time the pilot may initiate a descent from 460 feet MSL to land at IAH?

1—Anytime after GALES INT if the runway environment is visible.
2—Only after the IAH 1.3 DME if the runway environment is visible.
3—Only after the IAH 1 DME if the runway environment is visible.

**5605.** (Refer to figure 23.) How should the pilot identify the MAP on the IAH VOR/DME RWY 32R?

1—After time has elapsed from FAF.
2—IAH 1.3 DME.
3—IAH 1 DME.

**5606.** (Refer to figure 23.) At what point may the missed approach be initiated on the VOR/DME RWY 32R approach at IAF?

1—Anytime after the FAF.
2—IAH 1.3 DME.
3—IAH 1 DME.

**5607.** (Refer to figures 20, 21, 23, and 24.) What is the ETE from DFW to landing at IAH?

1—2 hours 05 minutes.
2—2 hours 19 minutes.
3—2 hours 22 minutes.

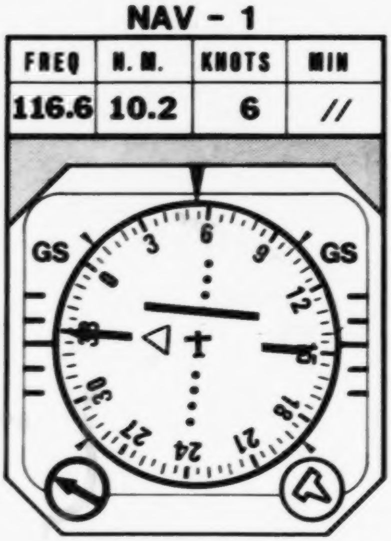
**5608.** (Refer to figures 20, 21, 23, and 24.) What is the total fuel required for the flight from DFW to IAH?

1—140 pounds.
2—270 pounds.
3—206 pounds.

**5609.** (Refer to figures 20, 21, 23, and 24.) What TAS should be maintained to arrive at BILEE.CUGAR4 initial point 1 hour 5 minutes after level-off?

1—136 knots.
2—143 knots.
3—146 knots.

**5610.** (Refer to figure 23.) What is the position of this flight on the VOR/DME RWY 32R approach at Houston?



1—On missed approach 14.8 NM from GOMER INT.
2—Outside the 10 DME arc approaching R-125.
3—At the IAF on R-061.

**5611.** (Refer to figure 25.) What is the maximum approach speed for the COPTER VOR/DME 117° approach?

1—60 knots.
2—90 knots.
3—91 knots.

**5612.** (Refer to figure 25.) What type approach lights are available for the COPTER VOR/DME 117° approach?

1—REIL and MIRL only.
2—Nonstandard REIL only.
3—REIL and nonstandard VASI only.

**5613.** (Refer to figure 25.) What NOTAM's are available at Houma-Terrebonne Airport?

1—NOTAM D and L.
2—NOTAM L only.
3—NOTAM D only.

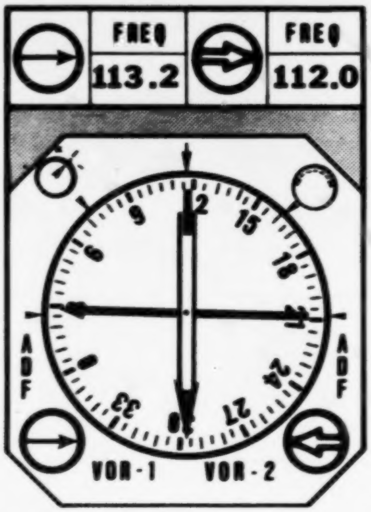
**5614.** (Refer to figure 25.) If the COPTER VOR/DME 117° approach is executed at 0630 local standard time, what minimums must be observed?

1—440/1/2.
2—580/1/2.
3—580/3/4.

**5615.** (Refer to figure 25.) What is the VASI approach slope angle for Rwy 12 at Houma-Terrebonne?

1—2.5°.
2—3.0°.
3—3.5°.

**5616.** (Refer to figure 25.) Determine the position of this flight on the COPTER VOR/DME 117° approach.



1—Approaching IAF TIBBY.
2—Starting to turn from the 5 DME arc to final approach.
3—Approaching BOURG INT during the missed approach procedure.

**5617.** (Refer to figure 25.) What type entry is appropriate for the missed approach holding pattern at Houma-Terrebonne?

1—Direct only.
2—Parallel or teardrop.
3—Teardrop only.

**5618.** (Refer to figure 25.) At what point may the missed approach be initiated?

1—TBD 10.2 DME.
2—Upon expiration of time from FAF.
3—Anytime after FAF.

**5619.** (Refer to figure 26.) What is the distance from the IAF to KINGS INT for the LDA/DME-2 RWY 18 approach?

1—19 DME miles.
2—20.4 DME miles.
3—21.3 DME miles.

**5620.** (Refer to figure 26.) Why is the localizer at South Lake Tahoe designated as LDA/DME?

1—DME is substituted for an outer marker.
2—The localizer is not aligned with the runway and all fixes are DME.
3—The localizer is wider than the standard ILS LOC and all fixes are DME.

**5621.** (Refer to figure 26.) What approach lighting is available for the LDA/DME-2 RWY 18 approach?

1—MIRL.
2—MIRL and 2-light VASI.
3—MALSF with sequenced flashing lights and 2-box VASI.

**5622.** (Refer to figure 26.) What is the minimum altitude for Category D aircraft at the FAF for the S-18 LDA/DME-21 RWY 18 approach?

1—8,120 feet.
2—8,480 feet.
3—8,900 feet.

**5623.** (Refer to figure 26.) On which IFR Low Altitude Charts can Lake Tahoe be found?

1—L panel 2G and Helicopter 5A.
2—2 panel G and 5 panel A.
3—H-2G, L-2G, and 5A.

**5624.** The threshold crossing height listed in figure 26 for the VASI on Rwy 18 is

1—6,254 feet MSL.
2—6,367 feet MSL.
3—47 feet AGL.

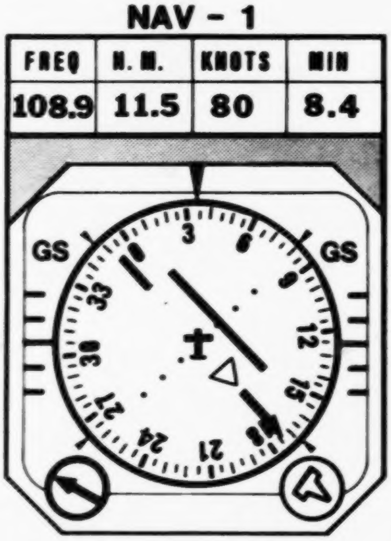
**5625.** (Refer to figure 26.) Approximately what rate of descent at 120 knots is necessary for the LDA/DME-2 RWY 18 approach at Lake Tahoe?

1—250 ft/min.
2—500 ft/min.
3—600 ft/min.

**5626.** (Refer to figure 26.) How can a pilot activate the approach lights to medium intensity at Lake Tahoe when the tower is closed?

1—Contact the FSS on CTAF frequency.
2—Key the mike three times on Unicom frequency.
3—Key the mike five times on CTAF frequency.

**5627.** (Refer to figure 26.) What is the position of this flight on the missed approach holding pattern at Lake Tahoe?



1—Turning from outbound leg.
2—Off course to the right inbound.
3—Turning on to the outbound leg.

**5628.** (Refer to figure 27.) From whom can a pilot request a DF steer in the Salisbury area?

1—Salisbury FSS.
2—Leesburg FSS.
3—Patuxent Approach Control.

**5629.** (Refer to figure 27.) Why is there an apperent difference in course direction on the plan view of the LOC BC RWY 14 approach?

1—The localizer bends.
2—To adjust for the nearby obstacles.
3—136° is the LOC course and 134° is a radial of SBY.

**5630.** (Refer to figure 27.) When may the missed approach at SBY be initiated if the aircraft is equipped with DME?

1—Anytime after SBY 3 DME.
2—When time has expired from the FAF.
3—Anytime after reaching the MDA.

**5631.** (Refer to figure 27.) What type VASI is installed for Rwy 14 at SBY?

1—4-light VASI.
2—4-box VASI – 2 each side of runway.
3—4-box VASI – all on left side of runway.

**5632.** (Refer to figure 27.) What is the purpose of the holding pattern at HEBRO INT on the LOC BC RWY 14 approach at SBY?

1—Timed approaches and course reversals.
2—En route and approach delays.
3—Climb or descent corridor and approach delays.

**5633.** (Refer to figure 27.) What type facility is WATERLOO as depicted on the plan view of the LOC BC RWY 14 approach at SBY?

1—VOR.
2—VOR/DME.
3—TACAN.

**5634.** (Refer to figure 27.) This flight is destined for the LOC BC RWY 14 approach at SBY. What minimum weather conditions must be forecast to avoid listing an alternate airport on the flight plan?

1—800/2-1/4.
2—1,000/3.
3—1,940/3-1/2.

**5635.** (Refer to figure 27.) What approach control facility, if any, is available when the tower is closed at SBY?

1—None.
2—Patuxent Approach Control.
3—Washington Center Approach Control.

**5636.** (Refer to figure 28.) Determine the minimum weather conditions for a Category D aircraft on the MLS RWY 19L approach that must be forecast to avoid listing an alternate airport on an IFR flight plan.

1—600/2.
2—1,000/3.
3—3240/4.

**5637.** What are the azimuth limits on the MLS such as the one depicted in figure 28?

1—5° each side of the centerline.
2—10° each side of the centerline.
3—40° each side of the centerline.

**5638.** (Refer to figure 28.) What is the threshold crossing height established by the VASI on Rwy 19L at ICT?

1—47 feet.
2—52-1/2 feet.
3—55 feet.

**5639.** (Refer to figure 28.) Of what use is the back azimuth of the MLS at ICT?

1—Lateral guidance for the missed approach.
2—Backup system to replace front course failure.
3—Support for the DME/P system.

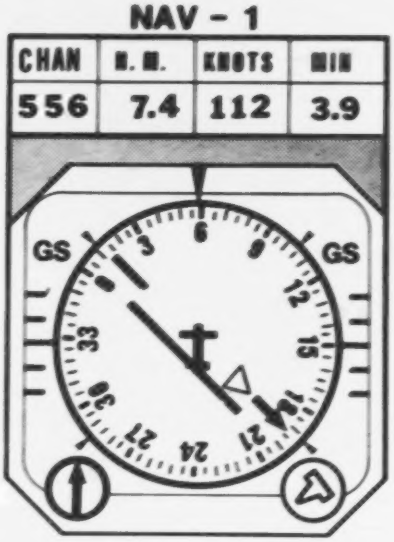
**5640.** (Refer to figure 28.) If 120 knots is maintained on the final approach of MLS RWY 19L, what rate of descent will maintain the glide slope?

1—600 ft/min.
2—635 ft/min.
3—675 ft/min.

**5641.** (Refer to figure 28.) Identify the FAF on the MLS RWY 19L approach at ICT.

1—M-JOZ 7.1 DME at 3,207 feet.
2—Interception of glidepath at 3,300 feet.
3—Interception of glidepath at any point.

**5642.** (Refer to figure 28.) What is the position of this flight on the MLS RWY 19L approach at ICT?



1—Turning inbound on the missed approach holding pattern.
2—On entry to the missed approach holding pattern.
3—Outbound on procedure turn.

**5643.** (Refer to figure 29.) This flight is destined for the NDB RWY 15 approach at CHS. What minimum weather conditions must be forecast to avoid listing an alternate airport on an IFR flight plan?

1—1,000/3.
2—1,980/3.
3—2,040/3.

**5644.** (Refer to figure 29.) What minimum navigation equipment is necessary for the NDB RWY 15 approach at CHS?

1—ADF.
2—ADF and VOR.
3—ADF, VOR, and DME.

**5645.** (Refer to figure 29.) When may the pilot initiate a missed approach on the NDB RWY 15 approach at CHS?

1—Anytime after the FAF.
2—At the CHS 2.5 DME.
3—At expiration of time after FAF.

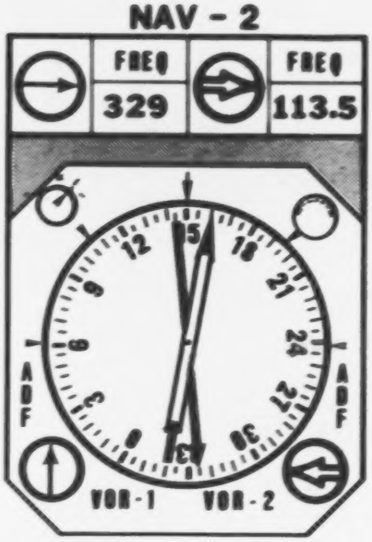
**5646.** (Refer to figure 29.) At what point on the NDB RWY 15 approach at CHS may the pilot descend below the MDA if the runway environment is in sight?

1—Only after the CHS 2.5 DME.
2—Only after the time to MDA has expired.
3—Anytime after the FAF.

**5647.** (Refer to figure 29.) What are the landing minimums for a Category C aircraft on a straight-in NDB RWY 15 approach at CHS if the touchdown zone lights and centerline lighting are inoperative?

1—480/40.
2—480/50.
3—530/60.

**5648.** (Refer to figure 29.) Determine the position of this flight on the NDB RWY 15 approach according to the indications of the RMI.



1—Inbound on the procedure turn.
2—Left of course approaching the airport.
3—On missed approach turning to intercept CHS R-055.

**5649.** (Refer to figure 29.) If the aircraft approaches on final at 110 knots, what will be the time from FAF to MAP on the NDB RWY 15 approach at CHS?

1—2 hours 27 minutes.
2—2 hours 30 minutes.
3—2 hours 37.5 minutes.

**5650.** (Refer to figure 30.) Identify the IAF(s) for the SDF RWY 31 approach at Reidsville.

1—KLUTE INT.
2—Slammer NDB.
3—Greensboro VORTAC, Martinsville VOR/DME, and Danville VOR.

**5651.** (Refer to figure 30.) What minimum navigation equipment is necessary for the SDF RWY 31 approach at Reidsville?

1—VOR receiver.
2—ILS receiver.
3—ILS and ADF receivers.

**5652.** (Refer to figure 30.) What does the negative "L" on the plan view of the SDF RWY 31 represent?

1—The tower is on a UNICON frequency.
2—MIRL and VASI are activated by keying UNICOM frequency.
3—Approach lighting on Rwy 13 and Rwy 31 are nonstandard.

**5653.** (Refer to figure 30.) If the aircraft approaches on final at 115 knots, what will be the time from FAF to MAP on the SDF RWY 31 approach at Reidsville?

1—2 hours 34 minutes.
2—2 hours 37 minutes.
3—2 hours 40 minutes.

**5654.** (Refer to figure 30.) Why is the SDF RWY 31 approach classified as SDF rather than LOC RWY 31?

1—There is no outer marker.
2—The procedure turn is nonstandard.
3—The localizer course is wider than an ILS LOC course.

**5655.** (Refer to figure 31.) What is the landing minimum for a Category D aircraft for the ASR RWY 16 approach at Ashville Regional?

1—3,000-foot MDA.
2—2-3/4 miles visibility.
3—900-foot ceiling.

**5656.** (Refer to figure 31.) What are the Category C approach minimums for the ASR RWY S-8R approach at Atlanta/Fulton County Airport?

1—1,540/2.
2—1,590/2.
3—1,540/1-1/2.

**5657.** (Refer to figure 31.) What are the ASR RWY 20L approach minimums for Category A aircraft at Atlanta/Dekalb-Peachtree Airport with the MALSF inoperative and using the Fulton County-Brown Field altimeter setting?

1—1,560/3/4.
2—1,560/1-1/4.
3—1,610/1-1/4.

**5658.** (Refer to figure 31.) What are the ASR RWY 20L approach minimums for Category C aircraft at Atlanta/Dekalb-Peachtree with the MALSF inoperative and using the Fulton County-Brown Field altimeter setting?

1—1,520/1-1/2.
2—1,560/1-1/2.
3—1,560/2.

**5659.** (Refer to figure 31.) Determine ASR approach minimums for Category C aircraft on Rwy 8L at Atlanta/The William B. Hartsfield if the ALFS2 is inoperative.

1—1,480/40.
2—1,530/60.
3—1,480/60.

**5660.** What information is provided by the MLS precision navigation system?

1—Azimuth, elevation, and distance information.
2—Azimuth, elevation, and three-letter identification.
3—Range, elevation, and ISMLS readouts.

**5661.** In addition to basic information, what expansion capabilities does the MLS have?

1—Back azimuth glide slope.
2—Back azimuth and data transmissions.
3—Variable front and back azimuth upon request.

**5662.** What azimuth coverage of the MLS can be expected?

1—Laterally 20° each side, vertically 15° to 20,000 feet, and range 50 NM.
2—Laterally 40° each side, vertically 15° to 20,000 feet, and range 20 NM.
3—Laterally 15° each side, vertically 6° to 20,000 feet, and range 20 NM.

**5663.** What is the difference, if any, between the front and back azimuth of the MLS?

1—None, except indicator reversal.
2—Transmissions are at a lower rate.
3—Back azimuth has no DME/P.

**5664.** In addition to navigation information, what data is transmitted on the MLS frequencies?

1—MLS status, missed approach procedure, and airport conditions.
2—ATC clearances, missed approach procedures, and airport conditions.
3—MLS status, airport conditions, and weather.

**5665.** What does operational flexibility of the MLS system include?

1—Selectable glidepath angles and boundaries providing obstruction clearance in the terminal area.
2—An azimuth of 40° in width providing obstacle clearance within 22 NM of the airport.
3—Curved and segmented approaches collocated with a fixed glidepath angle.

**5666.** LORAN-C is based upon measurements of the difference in time arrival of pulses generated by what type radio stations?

1—A group of stations operating on the 108-115 MHz frequency band.
2—Two stations operating on the 90-110 MHz frequency band.
3—A chain of stations operating on the 90-110 MHz frequency band.

**5667.** For what service has LORAN-C been approved?

1—IFR navigation in U.S. coastal areas and nonprecision approaches.
2—VFR navigation in the 48 contiguous states and District of Columbia.
3—IFR and VFR navigation in the 48 contiguous states and District of Columbia.

**5668.** What kind of network makes up the OMEGA Navigation System.

1—Four basic navigation facilities having worldwide signal coverage.
2—Eight stations transmitting on four basic navigation frequencies.
3—Four basic navigation facilities transmitting on four basic navigation frequencies.

**5669.** When is an OMEGA station said to be operating in full format?

1—The station is transmitting on the basic frequencies plus the unique frequency.
2—The station is transmitting on one of the four basic frequencies in the VLF range.
3—The station is transmitting on eight VHF frequencies, plus four discreet frequencies.

**5670.** What information does OMEGA provide?

1—Uninterrupted azimuth guidance and tracking.
2—Fixing information to an accuracy of plus or minus 2 NM.
3—Guidance, tracking, and fixing information.

**5671.** Under what condition may OMEGA navigation be used in the conterminous United States and Alaska?

1—The equipment is tested within the previous 30 days.
2—The equipment is used in conjunction with an inertial navigation system.
3—All navigation equipment otherwise required by the FAA be installed and operating.

**5672.** What type navigation system is Inertial Navigation System (INS)? A navigation computer which provides position

1—from information by compass, airspeed, and an input of wind and variation data.
2—from radar type sensors that measure ground speed and drift angles.
3—by signals from self-contained gyros and accelerometers.

**5673.** What is a Flight Management System (FMS)?

1—A computer system programmed to update position by reference to conventional navigation aids.
2—A transponder type navigation system which receives data for positions from satellites.
3—A doppler radar system, computerized to provide position from groundspeed and variations of direction.

**5674.** What functions are provided by ILS?

1—Azimuth, distance, and vertical angle.
2—Azimuth, range, and vertical angle.
3—Guidance, range, and visual information.

**5675.** Which component associated with the ILS is identified by the last two letters of the localizer group?

1—Inner marker.
2—Middle compass locator.
3—Outer compass locator.

**5676.** Which component associated with the ILS is identified by the first two letters of the localizer identification group?

1—Inner marker.
2—Middle compass locator.
3—Outer compass locator.

**5677.** What aural and visual indications should be observed over an ILS inner marker?

1—Continuous dots at the rate of six per second.
2—Continuous dashes at the rate of two per second.
3—Alternate dots and dashes at the rate of two per second.

**5678.** What aural and visual indications should be observed over an ILS middle marker?

1—Continuous dots at the rate of six per second.
2—Continuous dashes at the rate of two per second.
3—Alternate dots and dashes at the rate of two per second

**5679.** What aural and visual indications should be observed over an ILS outer marker?

1—Continuous dots at the rate of six per second.
2—Continuous dashes at the rate of two per second.
3—Alternate dots and dashes at the rate of two per second.

**5680.** What frequency range does the localizer transmitter of the ILS operate within?

1—108.10 to 118.10 MHz.
2—108.10 to 111.95 MHz.
3—108.10 to 117.95 MHz.

**5681.** What aural and visual indications should be observed over the ILS back course marker?

1—A series of two dot combinations.
2—Continuous dashes at the rate of one per second.
3—A series of two dash combinations.

**5682.** The lowest ILS Category II minimums are

1—DH 50 feet and RVR 1,200 feet.
2—DH 100 feet and RVR 1,200 feet.
3—DH 150 feet and RVR 1,500 feet.

**5683.** What is the lowest Category IIIA minimum?

1—DH 50 feet and RVR 1200 feet.
2—RVR 1,000 feet.
3—RVR 700 feet.

**5684.** How does the SDF differ from an ILS LOC?

1—SDF — 6° or 12° wide, ILS — 3° to 6°.
2—SDF — offset from runway plus 3°, ILS — aligned with runway.
3—SDF — 15° usable off course indications, ILS — 35°.

**5685.** How does the LDA differ from an ILS LOC?

1—LDA - 6° or 12° wide, ILS - 3° to 6°.
2—LDA - offset from runway plus 3°, ILS - aligned with runway.
3—LDA - 15° usable off course indications, ILS - 35°.

**5686.** What DME indications should a pilot observe when directly over a VORTAC site at 12,000 feet?

1—0 DME miles.
2—2 DME miles.
3—2.3 DME miles.

**5687.** Where does the DME indicator have the greatest error between the ground distance and displayed distance to the VORTAC?

1—High altitudes close to the VORTAC.
2—Low altitudes close to the VORTAC.
3—Low altitudes far from the VORTAC.

**5688.** What does the tri-color VASI consist of?

1—Three light bars; red, green, and amber.
2—One light projector with three colors; red, green, and amber.
3—Three glide slopes, each a different color; red green, and amber.

**5689.** Which color on a tri-color VASI is a "high" indication?

1—Red.
2—Amber.
3—Green.

**5690.** Which color on a tri-color VASI is an "on course" indication?

1—Red.
2—Amber.
3—Green.

**5691.** Which color on a tri-color VASI is a "low" indication?

1—Red.
2—Amber.
2—Green.

**5692.** What is the normal range of the tri-color VASI at night?

1—5 miles.
2—10 miles.
3—15 miles.

**5693.** What does the Precision Approach Path Indicator (PAPI) consist of?

1—Row of four lights parallel to the runway; red, white, and green.
2—Row of four lights perpendicular to the runway; red and white.
3—One light projector with two colors; red and white.

**5694.** What are the indications of PAPI?

1—High—white, on glidepath—red and white; low—red.
2—High—white, on glidepath—green; low—red.
3—High—white and green, on glidepath—green; low—red.

**5695.** What does the pulsating VASI consist of?

1—Three-light system, two pulsing and one steady.
2—Two-light projectors, one pulsing and one steady.
3—One-light projector, pulsing (some steady for on course).

**5696.** What are the indications of the pulsating VASI?

1—High—pulsing white, on glidepath—green; low—pulsing red.
2—High—pulsing white, on glidepath—pulsing red and white or steady white; low—pulsing red.
3—High—pulsing white, on course and on glidepath—steady white, off course but on glidepath—pulsing white and red; low—pulsing red.

**5697.** What is the advantage of a three-bar VASI?

1—Pilots have a choice of glide angles.
2—A normal glide angle is afforded both high and low cockpit aircraft.
3—The three-bar VASI is much more visible and can be used at a greater height.

**5698.** A pilot of a high-performance airplane should be aware that flying a steeper-than-normal VASI glide slope angle may result in

1—a hard landing.
2—increased landing rollout.
3—landing short of the runway threshold.

**5699.** The higher glide slope of the three-bar VASI is intended for use by

1—high performance aircraft.
2—helicopters.
3—high cockpit aircraft.

**5700.** What is the purpose of REIL?

1—Identification of a runway surrounded by a preponderance of other lighting.
2—Identification of the touchdown zone to prevent landing short.
3—Establish visual descent guidance information during an approach.

**5701.** Identify REIL.

1—Amber lights for the first 2,000 feet of runway.
2—Green lights at the threshold and red lights at far end of runway.
3—Synchronized flashing lights laterally at each side of the runway threshold.

**5702.** What is the advantage of HIRL or MIRL on an IFR runway as compared to a VFR runway?

1—Lights are closer together and easily distinguished from surrounding lights.
2—Amber lights replace white on the last 2,000 feet of runway for a caution zone.
3—Alternate red and white lights replace the white on the last 3,000 feet of runway for a caution zone.

**5703.** Identify touchdown zone lighting (TDZL).

1—Two rows of transverse light bars disposed symmetrically about the runway centerline.
2—Flush centerline lights spaced at 50-foot intervals extending through the touchdown zone.
3—Alternate white and green center line lights extending from 75 feet from the threshold through the touchdown zone.

**5704.** Identify runway remaining lighting on centerline lighting systems.

1—Amber lights from 3,000 feet to 1,000 feet, then alternate red and white lights to the end.
2—Alternate red and white lights from 3,000 feet to 1,000 feet, then red lights to the end.
3—Alternate red and white lights from 3,000 feet to the end of the runway.

**5705.** Identify taxi turnoff lights associated with the centerline lighting system.

1—Alternate blue and white lights curving from the centerline of the runway to the centerline of the taxiway.
2—White lights curving from the centerline of the runway to the centerline of the taxiway.
3—Blue lights curving from the centerline of the runway to the centerline of the taxiway.

**5706.** How can a pilot identify a military airport at night?

1—Green, yellow, and white beacon light.
2—White and red beacon light with dual flash of the white.
3—Green and white beacon light with dual flash of the white.

**5707.** How can a pilot identify a lighted heliport at night?

1—Green, yellow, and white beacon light.
2—White and red beacon light with dual flash of the white.
3—Green and white beacon light with dual flash of the white.

**5708.** Identify the runway distance remaining markers.

1—Signs with increments of 1,000 feet distance remaining.
2—Red markers laterally placed across the runway at 3,000 feet from the end.
3—Yellow marker laterally placed across the runway with signs on the side denoting distance to end.

**5709.** What restriction applies to a large, turbine-powered airplane operating to or from a primary airport in a TCA?

1—Must not exceed 200 knots within the TCA.
2—Must operate above the floor when within lateral limits of the TCA.
3—Must operate in accordance with IFR procedures regardless of weather conditions.

**5710.** What service is provided for aircraft operating within the outer area of an ARSA?

1—The same as within the ARSA when communications and radar contact is established.
2—Radar vectors to and from secondary airports within the outer area.
3—Basic radar service only when communications and radar contact is established.

**5711.** What services are provided for aircraft operating within the ARSA?

1—Sequencing of arriving aircraft, separation of aircraft (except between VFR aircraft), and traffic advisories.
2—Sequencing of arriving aircraft (except VFR aircraft), separation between all aircraft, and traffic advisories.
3—Sequencing of all arriving aircraft, separation between all aircraft, and traffic advisories.

**5712.** What pilot certification and aircraft equipment are required for operating in an ARSA?

1—No specific certification but a two-way radio.
2—At least a private pilot certificate and two-way radio.
3—At least a private pilot certificate, two-way radio, and a TSO-C74b transponder.

**5713.** What hazards to aircraft and its occupants may exist in restricted areas?

1—High speed military aircraft maneuvers.
2—Invisible hazards such as artillery firing or guided missiles.
3—Classified military operations of a hazardous nature.

**5714.** Why are certain areas classified as Warning Areas?

1—Any hazards within may be avoided easily with good vigilance.
2—Hazardous operations are rare but inquiries should be made prior to entering the area.
3—Invisible hazards exist in international airspace which cannot be controlled.

**5715.** What is the purpose of MOA's?

1—To protect military aircraft operations from civil aircraft.
2—To separate military training activities from IFR traffic.
3—To separate military training activities from both IFR and VFR traffic.

**5716.** Who is responsible for collision avoidance in an MOA?

1—Military controllers.
2—ATC controllers.
3—Each pilot.

**5717.** Which aeronautical chart depicts Military Training Routes (MTR) above 1,500 feet?

1—IFR Low Altitude En Route Chart.
2—IFR High Altitude En Route Chart.
3—IFR Planning Chart.

**5718.** Under what condition does ATC issue Safety Alerts?

1—When collision with another aircraft is imminent.
2—If the aircraft altitude is noted to be in close proximity to the surface or an obstacle.
3—When weather conditions are extreme and wind shear or large hail is in the vicinity.

**5719.** What is the hijack code?

1—7200.
2—7500.
3—7777.

**5720.** Which range of codes should a pilot avoid switching through when changing transponder codes.

1—0000 through 1000.
2—7200 and 7500 series.
3—7500, 7600, and 7700 series.

**5721.** To assure expeditious handling of a civilian air ambulance flight, the word "LIFEGUARD" should be entered in which section of the flight plan?

1—Aircraft type/special equipment block.
2—Pilot's name and address block.
3—Remarks block.

**5722.** What airport condition is reported by the tower when more than one wind condition at different positions on the airport is reported?

1—Light and variable.
2—Wind shear.
3—Frontal passage.

**5723.** How should a pilot describe braking action?

1—00 percent, 50 percent, 75 percent, or 100 percent.
2—Zero-zero, fifty-fifty, or normal.
3—Nil, poor, fair, or good.

**5724.** When "gate hold" procedures are in effect, what action should the pilot take?

1—Contact ground control prior to starting engines for sequencing.
2—Taxi into position and hold prior to requesting clearance.
3—Start engines, perform pretakeoff check, and request clearance prior to leaving the parking area.

**5725.** What special consideration is given for turbine-powered aircraft when "gate hold" procedures are in effect?

1—They are given preference for departure over other aircraft.
2—They are expected to be ready for takeoff when they reach the runway or warmup block.
3—They are expected to be ready for takeoff prior to taxi and will receive takeoff clearance prior to taxi.

**5726.** Under what situations are faster/larger helicopters integrated with fixed-wing aircraft?

1—IFR flights, noise avoidance routes, and use of runways or taxiways.
2—Use of taxiways, sequencing for takeoff and landing, and use of the same traffic patterns.
3—Use of taxiways, sequencing for takeoff and landing, and use of the same loading ramps.

**5727.** What is a helicopter pilot's responsibility when cleared to "air taxi" on the airport?

1—Taxi direct to destination as quickly as possible.
2—Taxi at hover altitude using taxiways.
3—Taxi below 100 feet AGL avoiding other aircraft and personnel.

**5728.** What action is expected of an aircraft upon landing at a controlled airport?

1—Continue taxiing in the landing direction until advised by the tower to switch to ground control frequency.
2—Exit the runway at the nearest suitable taxiway and remain on tower frequency until instructed otherwise.
3—Exit the runway at the nearest suitable taxiway and switch to ground control upon crossing the taxiway holding lines.

**5729.** What is the pilot's responsibility for clearance or instruction readback?

1—Except for SID's, read back altitude assignments, altitude restrictions, and vectors.
2—If the clearance or instruction is understood, an acknowledgment is sufficient.
3—Read back the entire clearance or instruction to confirm the message is understood.

**5730.** Under what conditions may a pilot on an IFR flight plan comply with authorization to maintain "VFR on Top"?

1—Maintain IFR flight plan but comply with visual flight rules while in VFR conditions.
2—Maintain VFR altitudes, cloud clearances, and comply with applicable instrument flight rules.
3—Maintain IFR altitudes, VFR cloud clearances, and comply with applicable instrument flight rules.

**5731.** What cloud clearance must be complied with when authorized to maintain "VFR On Top"?

1—May maintain VFR clearance above, below, or between layers.
2—Must maintain VFR clearance above or below.
3—May maintain VFR clearance above or below, but not between layers.

**5732.** In what areas will ATC not authorize "VFR On Top"?

1—ARSA's and TCA's.
2—Continental Control Area.
3—PCA's.

**5733.** What separation or service by ATC is afforded pilots authorized "VFR On Top"?

1—The same afforded all IFR flights.
2—3 miles horizontally instead of 5.
3—Traffic advisories only.

**5734.** When a speed adjustment is necessary to maintain separation, what minimum speed may ATC request of a turbine-powered aircraft operating below 10,000 feet?

1—200 knots.
2—210 knots.
3—250 knots.

**5735.** When a speed adjustment is necessary to maintain separation, what minimum speed may ATC request of a turbine-powered aircraft departing an airport?

1—188 knots.
2—210 knots.
3—230 knots.

**5736.** If ATC requests a speed adjustment that is not within the operating limits of the aircraft, what action must the pilot take?

1—Maintain an airspeed within the operating limitations as close to the requested speed as possible.
2—Attempt to use the requested speed as long as possible, then request a reasonable airspeed from ATC.
3—Advise ATC of the airspeed that will be used.

**5737.** What are FDC NOTAM's?

1—Conditions of facilities en route that may cause delays.
2—Time critical aeronautical information of a temporary nature from distant centers.
3—Regulatory amendments to published IAP's and charts not yet available in normally published charts.

**5738.** What type information is disseminated from NOTAM D's?

1—Status of navigation aids, ILS's, radar service available, and other information essential to planning.
2—Airport or primary runway closings, runway and taxiway conditions, and airport lighting aids outages.
3—Temporary flight restrictions, changes in status in navigational aids, and updates on equipment such as VASI.

**5739.** What type information is disseminated from NOTAM L's?

1—Conditions of facilities en route that may cause delays.
2—Airport or primary runway closings, runway and taxiway conditions, and airport lighting aids outages.
3—Time critical information of a permanent nature that is not yet available in normally published charts.

**5740.** How often are NOTAM's broadcast to pilots on a scheduled basis?

1—15 minutes before and 15 minutes after the hour.
2—Between weather broadcasts on the hour.
3—Hourly, appended to the weather broadcast.

**5741.** When a composite flight plan indicates IFR for the first portion of the flight, what is the procedure for the transition?

1—The IFR portion is automatically canceled and the VFR portion is automatically activated when the pilot reports VFR conditions.
2—The pilot should advise ATC to cancel the IFR portion and contact the nearest FSS to activate the VFR portion.
3—The pilot should advise ATC to cancel the IFR portion and activate the VFR portion.

**5742.** Which IFR fix(es) should be entered on a composite flight plan?

1—All compulsory reporting points en route.
2—The VOR's that define the IFR portion of the flight.
3—The fix where the IFR portion is to be terminated.

**5743.** When a composite flight plan indicates VFR for the first portion of the flight, what is the procedure for the transition?

1—The VFR portion is automatically canceled and the IFR portion is automatically activated when the pilot reports IFR conditions.
2—The pilot should advise ATC to cancel VFR and activate the IFR portion of the flight.
3—The pilot should close the VFR portion with the nearest FSS and request the IFR clearance at least 5 minutes prior to IFR.

**5744.** What is the suggested time interval for filing and requesting an IFR flight plan?

1—File at least 30 minutes prior to departure and request the clearance not more than 10 minutes prior to taxi.
2—File at least 30 minutes prior to departure and request the clearance at least 10 minutes prior to taxi.
3—File at least 1 hour prior to departure and request the clearance at least 10 minutes prior to taxi.

**5745.** How should the route of flight be defined on an IFR flight plan?

1—A simplified route via airways or jet routes with transitions.
2—A route via airways or jet routes with VOR's and fixes used.
3—A route via airways or jet routes with only the compulsory reporting points.

**5746.** How should an off-airway direct flight be defined on an IFR flight plan?

1—The initial fix, the true course, and the final fix.
2—All radio fixes over which the flight will pass.
3—The initial fix, all radio fixes which the pilot wishes to be compulsory reporting points, and the final fix.

**5747.** How are RNAV routes defined on the IFR flight plan?

1—Define each waypoint using degree-distance fixes based on appropriate navigational aids or by latitude/longitude.
2—List the initial and final fix with at least one waypoint each 200 NM.
3—The initial and final fix must be an established radio fix, then each waypoint in between is defined using degree-distance fixes based on appropriate navigational aids.

**5748.** What is one limitation when filing a random RNAV route on an IFR flight plan?

1—The waypoints must be located within 200 NM of each other.
2—The entire route must be within radar environment.
3—The waypoints may only be defined by degree-distance fixes based on appropriate navigational aids.

**5749.** Under what condition may a pilot cancel an IFR flight plan prior to completing the flight?

1—Anytime it appears the clearance will cause a deviation from FAR.
2—Anytime within controlled airspace by contacting ARTCC.
3—Only if in VFR conditions in other than a PCA.

**5750.** What minimum information does an abbreviated departure clearance "cleared as filed" include?

1—Clearance limit and en route altitude.
2—Clearance limit, en route altitude, and SID, if appropriate.
3—Destination airport, en route altitude, and SID, if appropriate.

**5751.** Under what condition does a pilot receive a "void time" specified in the clearance?

1—On an uncontrolled airport.
2—When "gate hold" procedures are in effect.
3—If the clearance is received prior to starting engines.

**5752.** What is the normal procedure for IFR departures at locations with pretaxi clearance programs?

1—Pilots request IFR clearance when ready to taxi. The pilot will receive taxi instruction with clearance.
2—Pilots request IFR clearance when ready to taxi. Pilots will receive taxi clearance, then receive IFR clearance while taxiing or on runup.
3—Pilots request IFR clearance 10 minutes or less prior to taxi, then request taxi clearance from ground control.

**5753.** What is the purpose of the term "hold for release" when included in an IFR clearance?

1—A procedure for delaying departure for traffic volume, weather, or need to issue further instructions.
2—When an IFR clearance is received by telephone, the pilot will have time to prepare for takeoff prior to being released.
3—Gate hold procedures are in effect and the pilot receives an estimate of the time the flight will be released.

**5754.** On what performance is obstacle clearance based for IFR departures, including SID's? Cross end of runway plus 35 feet AGL,

1—then minimum climb of 150 feet per NM after takeoff.
2—climb to 400 feet prior to turn at the end of the runway, and then climb at least 200 feet per NM.
3—climb to 400 feet prior to turn at the end of the runway, and then climb at least 150 feet per NM.

**5755.** In what way are SID's depicted in plan view?

1—"Vectors" provided for navigational guidance or "Pilot NAV" with courses the pilot is responsible to follow.
2—"Vectors" and "Pilot NAV" for pilots to use at their discretion.
3—Combined textual and graphic form which are mandatory routes and instructions.

**5756.** What action should a pilot take if asked by ARTCC to "VERIFY 9,000" and the flight is actually maintaining 8,000?

1—Immediately climb to 9,000.
2—Report climbing to 9,000.
3—Report maintaining 8,000.

**5757.** Where are position reports required on an IFR flight on airways or routes?

1—Over all designated compulsory reporting points.
2—Only where specifically requested by ARTCC.
3—When requested to change altitude or advise of weather conditions.

**5758.** Which reports are required when operating IFR in radar environment?

1—Position reports, vacating an altitude, unable to climb 500 feet per minute, and time and altitude reaching a holding fix or point to which cleared.
2—Position reports, vacating an altitude, unable to climb 500 feet per minute, time and altitude reaching a holding fix or point to which cleared, and a change in average true airspeed exceeding 5 percent or 10 knots.
3—Vacating an altitude, unable to climb 500 feet per minute, time and altitude reaching a holding fix or point to which cleared, a change in average true airspeed exceeding 5 percent or 10 knots, and leaving any assigned holding fix or point.

**5759.** Which reports are always required when on an IFR approach not in radar contact?

1—Leaving FAF inbound or outer marker inbound and missed approach.
2—Leaving FAF inbound, leaving outer marker inbound or outbound, and missed approach.
3—Leaving FAF inbound, leaving outer marker inbound or outbound, procedure turn outbound and inbound, and visual contact with the runway.

**5760.** What action should a pilot take if within 3 minutes of a clearance limit and further clearance has not been received?

1—Assume lost communications and continue as planned.
2—Plan to hold at cruising speed until further clearance is received.
3—Start a speed reduction to holding speed in preparation for holding.

**5761.** What report should the pilot make at a clearance limit?

1—Time and altitude/flight level arriving or leaving.
2—Time, altitude/flight level, and expected holding speed.
3—Time, altitude/flight level, expected holding speed, and inbound leg length.

**5762.** Maximum holding speed for a propeller-driven airplane is

1—156 knots.
2—175 knots.
3—210 knots.

**5763.** Maximum holding speed for a turbojet airplane above 14,000 feet is

1—210 knots.
2—230 knots.
3—265 knots.

**5764.** Maximum holding speed for a turbojet airplane between 6,000 and 14,000 feet is

1—175 knots.
2—200 knots.
3—210 knots.

**5765.** When using a flight director system, what rate of turn or bank angle should a pilot observe during turns in a holding pattern?

1—3° per second or 25° bank, whichever is less.
2—3° per second or 30° bank, whichever is less.
3—1-1/2° per second or 25° bank, whichever is less.

**5766.** When holding at an NDB, at what point should the timing begin for the second leg outbound?

1—Abeam the holding fix or when the wings are level after completing the turn to the outbound heading, whichever occurs first.
2—At the end of a 1-minute standard rate turn after station passage.
3—When abeam the holding fix.

**5767.** When entering a holding pattern above 14,000 feet, the initial outbound leg should not exceed

1—1 minute.
2—1-1/2 minutes.
3—1-1/2 minutes or 10 NM, whichever is less.

**5768.** What is the primary purpose of a STAR?

1—Provide separation between IFR and VFR traffic.
2—Simplify clearance delivery procedures.
3—Decrease traffic congestion at certain airports.

**5769.** When does ATC issue a STAR?

1—Only when ATC deems it appropriate.
2—Only to high priority flights.
3—Only upon request of the pilot.

**5770.** What action(s) should a pilot take if vectored across the final approach course during an IFR approach?

1—Continue on the last heading issued until otherwise instructed.
2—Contact approach control, and advise that the flight is crossing the final approach course.
3—Turn onto final, and broadcast in the blind that the flight has proceeded on final.

**5771.** While being vectored to the final approach course of an IFR approach, when may the pilot descend to published altitudes?

1—Anytime the flight is on a published leg of an approach chart.
2—When the flight is within the 10-mile ring of a published approach.
3—Only when Approach Control clears the flight for the approach.

**5772.** When is radar service terminated while vectored for an IFR approach at an uncontrolled airport?

1—Only upon landing or advised to change to advisory frequency.
2—When aligned on the final approach course.
3—When cleared for the approach.

**5773.** When cleared for an IFR approach to an uncontrolled airport with no FSS, what precaution should the pilot take after being advised to change to advisory frequency?

1—Monitor ATC for traffic advisories as well as UNICOM.
2—Broadcast intentions and continually update position reports on UNICOM.
3—Wait until visual contact is made with the airport and broadcast intentions to land.

**5774.** Under what condition may a pilot file an IFR flight plan containing a special or privately owned IAP?

1—Upon approval of ATC.
2—Upon approval of the owner.
3—Upon signing a waiver of responsibility.

**5775.** When may a pilot execute a missed approach during an ASR approach?

1—Anytime at the pilot's discretion.
2—Only at the MAP.
3—Only when advised by the controller.

**5776.** When simultaneous approaches are in progress, how does each pilot receive radar advisories?

1—On tower frequency.
2—On approach control frequency.
3—One pilot on tower frequency and the other on approach control frequency.

**5777.** When cleared to execute a published side-step maneuver, at what point is the pilot expected to commence this maneuver?

1—At the published DH.
2—At the MDA published or a circling approach.
3—As soon as possible after the runway environment is in sight.

**5778.** If visual reference is lost while circling to land from an instrument approach, what action(s) should the pilot take?

1—Make a climbing turn toward the landing runway until established on the missed approach course.
2—Turn toward the landing runway maintaining MDA, and if visual reference is not regained, perform missed approach.
3—Make a climbing turn toward the VOR/NDB, and request further instructions.

**5779.** What is the difference between a visual and a contact approach?

1—A visual approach is an IFR authorization while a contact approach is a VFR authorization.
2—A visual approach is initiated by ATC while a contact approach is initiated by the pilot.
3—Both are the same but classified according to the party initiating the approach.

**5780.** Except during an emergency, when can a pilot expect landing priority?

1—When cleared for an IFR approach.
2—When piloting a large heavy aircraft.
3—In turn, on a first come, first serve basis.

**5781.** Under what condition should a pilot on IFR advise ATC of minimum fuel status?

1—When the fuel supply becomes less than that required for IFR.
2—If the remaining fuel suggests a need for traffic or landing priority.
3—If the remaining fuel precludes any undue delay.

**5782.** What is the maximum acceptable tolerance for penetrating a domestic ADIZ?

1—Plus or minus 10 miles; plus or minus 10 minutes.
2—Plus or minus 20 miles; plus or minus 5 minutes.
3—Plus or minus 10 miles; plus or minus 5 minutes.

**5783.** What minimum condition is suggested for declaring an emergency?

1—Anytime the pilot is doubtful of a condition that could adversely affect flight safety.
2—When fuel endurance or weather will require an en route or landing priority.
3—When distress conditions such as fire, mechanical failure, or structural damage occurs.

**5784.** It is the responsibility of the pilot and crew to report a near midair collision as a result of proximity of at least

1—50 feet or less to another aircraft.
2—500 feet or less to another aircraft.
3—1,000 feet or less to another aircraft.

**5785.** When setting the altimeter, pilots should disregard

1—effects of nonstandard atmospheric temperatures and pressures.
2—corrections for static pressure systems.
3—corrections for instrument error.

**5786.** (Refer to figures 32, 35, and 36.) What is the CG in percent of MAC for Load Condition WT-1?

1—26.0 percent MAC.
2—27.1 percent MAC.
3—27.9 percent MAC.

**5787.** (Refer to figures 32, 35, and 36.) What is the CG in inches aft of datum for Load Condition WT-2?

1—908.8 inches.
2—909.6 inches.
3—910.7 inches.

**5788.** (Refer to figures 32, 35, and 36.) What is the CG in percent of MAC for Load Condition WT-3?

1—27.8 percent MAC.
2—28.9 percent MAC.
3—29.1 percent MAC.

**5789.** (Refer to figures 32, 35, and 36.) What is the CG in inches aft of datum for Load Condition WT-4?

1—908.4 inches.
2—909.0 inches.
3—909.5 inches.

**5790.** (Refer to figures 32, 35, and 36.) What is the CG in percent of MAC for Load Condition WT-5?

1—25.6 percent MAC.
2—26.7 percent MAC.
3—27.2 percent MAC.

**5791.** (Refer to figures 33, 35, and 36.) What is the gross weight index for Load Condition WT-6?

1—181,340.5 index.
2—156,545.0 index.
3—165,991.5 index.

**5792.** (Refer to figures 33, 35, and 36.) What is the CG in percent of MAC for Load Condition WT-7?

1—21.6 percent MAC.
2—22.9 percent MAC.
3—24.0 percent MAC.

**5793.** (Refer to figures 33, 35, and 36.) What is the CG in percent of MAC for Load Condition WT-8?

1—29.4 percent MAC.
2—30.0 percent MAC.
3—31.3 percent MAC.

**5794.** (Refer to figures 33, 35, and 36.) What is the gross weight index for Load Condition WT-9?

1—169,755.2 index.
2—158,797.9 index.
3—186,565.5 index.

**5795.** (Refer to figures 33, 35, and 36.) What is the CG in percent of MAC for Load Condition WT-10?

1—27.0 percent MAC.
2—27.8 percent MAC.
3—28.0 percent MAC.

**5796.** (Refer to figures 34, 35, and 36.) What is the CG in percent of MAC for Load Condition WT-11?

1—26.8 percent MAC.
2—27.5 percent MAC.
3—28.6 percent MAC.

**5797.** (Refer to figures 34, 35, and 36.) What is the CG in percent of MAC for Load Condition WT-12?

1—25.8 percent MAC.
2—26.3 percent MAC.
3—27.5 percent MAC.

**5798.** (Refer to figures 34, 35, and 36.) What is the CG in percent of MAC for Load Condition WT-13?

1—28.6 percent MAC.
2—29.4 percent MAC.
3—30.1 percent MAC.

**5799.** (Refer to figures 34, 35, and 36.) What is the CG in percent of MAC for Load Condition WT-14?

1—30.1 percent MAC.
2—29.5 percent MAC.
3—31.5 percent MAC.

**5800.** (Refer to figures 34, 35, and 36.) What is the CG in Percent of MAC for Load Condition WT-15?

1—32.8 percent MAC.
2—31.5 percent MAC.
3—29.5 percent MAC.

**5801.** What is the maximum allowable weight that may be carried on a pallet which has the dimensions of 76 X 76 inches?

Floor load limit - 186 lb/sq ft
Pallet weight - 93 lb
Tiedown devices - 39 lb

1—7,421.3 pounds.
2—7,250.3 pounds.
3—7,328.7 pounds.

**5802.** What is the maximum allowable weight that may be carried on a pallet which has the dimensions of 83 X 95 inches?

Floor load limit - 184 lb/sq ft
Pallet weight - 85 lb
Tiedown devices - 36 lb

1—10,075.3 pounds.
2—9,954.3 pounds.
3—10,028.6 pounds.

**5803.** What is the maximum allowable weight that may be carried on a pallet which has the dimensions of 84 X 84 inches?

Floor load limit - 169 lb/sq ft
Pallet weight - 88 lb
Tiedown devices - 37 lb

1—8,156.0 pounds.
2—8,281.0 pounds.
3—8,093.0 pounds.

**5804.** What is the maximum allowable weight that may be carried on a pallet which has the dimensions of 76 X 74 inches?

Floor load limit - 176 lb/sq ft
Pallet weight - 77 lb
Tiedown devices - 29 lb

1—6,767.8 pounds.
2—6,873.7 pounds.
3—6,796.8 pounds.

**5805.** What is the maximum allowable weight that may be carried on a pallet which has the dimensions of 81 X 83 inches?

Floor load limit — 180 lb/sq ft
Pallet weight — 82 lb
Tiedown devices — 31 lb

1—8,403.7 pounds.
2—8,321.8 pounds.
3—8,290.8 pounds.

**5806.** (Refer to figure 37.) What is the new CG if the weight is shifted from the forward to the aft compartment under Load Condition WS-1?

1—15.2 percent MAC.
2—28.9 percent MAC.
3—30.0 percent MAC.

**5807.** (Refer to figure 37.) What is the new CG if the weight is shifted from the aft to the forward compartment under Load Condition WS-2?

1—26.1 percent MAC.
2—20.5 percent MAC.
3—22.8 percent MAC.

**5808.** (Refer to figure 37.) What is the new CG if the weight is shifted from the forward to the aft compartment under Load Condition WS-3?

1—29.2 percent MAC.
2—33.0 percent MAC.
3—28.6 percent MAC.

**5809.** (Refer to figure 37.) What is the new CG if the weight is shifted from the aft to the forward compartment under Load Condition WS-4?

1—37.0 percent MAC.
2—23.5 percent MAC.
3—24.1 percent MAC.

**5810.** (Refer to figure 37.) Where is the new CG if the weight is shifted from the forward to the aft compartment under Load Condition WS-5?

1— +19.15 index arm.
2— +13.93 index arm.
3— -7.92 index arm.

**5811.** (Refer to figure 37.) What is the new CG if the weight is removed from the forward compartment under Load Condition WS-1?

1—27.1 percent MAC.
2—26.8 percent MAC.
3—30.0 percent MAC.

**5812.** (Refer to figure 37.) Where is the new CG if the weight is added to the aft compartment under Load Condition WS-2?

1— +17.06 index arm.
2— +14.82 index arm.
3— +12.13 index arm.

**5813.** (Refer to figure 37.) What is the new CG if the weight is added to the forward compartment under Load Condition WS-3?

1—11.4 percent MAC.
2—14.3 percent MAC.
3—14.5 percent MAC.

**5814.** (Refer to figure 37.) Where is the new CG if the weight is removed from the aft compartment under Load Condition WS-4?

1— +15.53 index arm.
2— +8.50 index arm.
3— -3.51 index arm.

**5815.** (Refer to figure 37.) What is the new CG if the weight is removed from the forward compartment under Load Condition WS-5?

1—31.9 percent MAC.
2—19.1 percent MAC.
3—35.2 percent MAC.

**5816.** (Refer to figures 38, 40, 42, 43, 44, and 45.) What is the CG in inches from datum under Loading Condition BE-1?

1—Station 290.3.
2—Station 285.8.
3—Station 291.8.

**5817.** (Refer to figures 38, 40, 42, 43, 44, and 45.) What is the CG in inches from datum under Loading Condition BE-2?

1—Station 295.2.
2—Station 292.9.
3—Station 293.0.

**5818.** (Refer to figures 38, 40, 42, 43, 44, and 45.) What is the CG in inches from datum under Loading Condition BE-3?

1—Station 288.2.
2—Station 285.8.
3—Station 290.4.

**5819.** (Refer to figures 38, 40, 42, 43, 44, and 45.) What is the CG in inches from datum under Loading Condition BE-4?

1—Station 297.4.
2—Station 299.6.
3—Station 297.7.

**5820.** (Refer to figures 38, 40, 42, 43, 44, and 45.) What is the CG in inches from datum under Loading Condition BE-5?

1—Station 288.9.
2—Station 290.5.
3—Station 289.1.

**5821** (Refer to figures 38, 40, 42, 43, 44, and 45.) What is the CG shift if the passengers in row 1 are moved to seats in row 9 under Loading Condition BE-1?

1—1.5 inches aft.
2—5.6 inches aft.
3—6.2 inches aft.

**5822.** (Refer to figures 38, 40, 42, 43, 44, and 45.) What is the CG shift if the passengers in row 1 are moved to row 8, and the passengers in row 2 are moved to row 9 under Loading Condition BE-2?

1—9.2 inches aft.
2—5.7 inches aft.
3—7.8 inches aft.

**5823.** (Refer to figures 38, 40, 42, 43, 44, and 45.) What is the CG shift if four passengers weighing 170 pounds each are added; two to seats in row 6 and two to seats in row 7, under Loading Condition BE-3?

1—3.5 inches aft.
2—2.2 inches forward.
3—1.8 inches aft.

**5824.** (Refer to figures 38, 40, 42, 43, 44, and 45.) What is the CG shift if all passengers in rows 2 and 4 are deplaned under Loading Condition BE-4?

1—2.5 inches aft.
2—2.5 inches forward.
3—2.0 inches aft.

**5825.** (Refer to figures 38, 40, 42, 43, 44, and 45.) What is the CG shift if the passengers in row 8 are moved to row 2, and the passengers in row 7 are moved to row 1, under Loading Condition BE-5?

1—1.0 inches forward.
2—8.9 inches forward.
3—6.5 inches forward.

**5826.** (Refer to figures 39, 41, 43, 44, and 45.) What is the CG in inches from datum under Loading Condition BE-6?

1—Station 296.5.
2—Station 296.1.
3—Station 297.0.

**5827.** (Refer to figures 39, 41, 43, 44, and 45.) What is the CG in inches from datum under Loading Condition BE-7?

1—Station 295.4.
2—Station 300.2.
3—Station 296.0.

**5828.** (Refer to figures 39, 41, 43, 44, and 45.) What is the CG in inches from datum under Loading Condition BE-8?

1—Station 296.9.
2—Station 297.4.
3—Station 298.1.

**5829.** (Refer to figures 39, 41, 43, 44, and 45.) What is the CG in inches from datum under Loading Condition BE-9?

1—Station 296.7.
2—Station 297.2.
3—Station 297.1.

**5830.** (Refer to figures 39, 41, 43, 44, and 45.) What is the CG in inches from datum under Loading Condition BE-10?

1—Station 293.9.
2—Station 293.0.
3—Station 292.8.

**5831.** (Refer to figures 39, 41, 43, 44, and 45.) What is the CG shift if 300 pounds of cargo in section A is moved to section H under Loading Condition BE-6?

1—4.0 inches aft.
2—2.5 inches aft.
3—4.3 inches aft.

**5832.** (Refer to figures 39, 41, 43, 44, and 45.) What is the CG shift if the cargo in section F is moved to section A, and 200 pounds of the cargo in section G is added to the cargo in section B, under Loading Condition BE-7?

1—5.2 inches forward.
2—4.0 inches forward.
3—8.0 inches forward.

**5833.** (Refer to figures 39, 41, 43, 44, and 45.) What is the CG if all cargo in sections A, B, J, K, and L are off-loaded under Loading Condition BE-8?

1—Station 291.9.
2—Station 292.7.
3—Station 294.5.

**5834.** (Refer to figures 39, 41, 43, 44, and 45.) What is the CG if cargo is loaded to bring sections F, G, and H to maximum capacity under Loading Condition BE-9?

1—Station 303.5.
2—Station 301.6.
3—Station 305.4.

**5835.** (Refer to figures 39, 41, 43, 44, and 45.) What is the CG shift if the cargo in section G is moved to section J under Loading Condition BE-10?

1—2.0 inches forward.
2—2.3 inches aft.
3—3.2 inches aft.

**5836.** (Refer to figures 41, 43, 45, and 46.) What limit is exceeded under Loading Condition BE-11?

1—ZFW limit is exceeded.
2—Aft CG limit is exceeded at takeoff weight.
3—Aft CG limit is exceeded at landing weight.

**5837.** (Refer to figures 41, 43, 45, and 46.) What limit(s) is(are) exceeded under Loading Condition BE-12?

1—ZFW limit is exceeded.
2—Landing aft CG limit is exceeded.
3—ZFW and maximum takeoff weight limits are exceeded.

**5838.** (Refer to figures 41, 43, 45, and 46.) What limit, if any, is exceeded under Loading Condition BE-13?

1—Takeoff forward CG limit is exceeded.
2—No limit is exceeded.
3—Landing aft CG limit is exceeded.

**5839.** (Refer to figures 41, 43, 45, and 46.) What limit(s) is(are) exceeded under Loading Condition BE-14?

1—Maximum ZFW limit is exceeded.
2—Takeoff forward CG limit is exceeded.
3—Maximum landing weight and landing forward CG limits are exceeded.

**5840.** (Refer to figures 41, 43, 45, and 46.) What limit(s) is(are) exceeded under Loading Condition BE-15?

1—Maximum takeoff weight limit is exceeded.
2—Maximum ZFW and takeoff forward CG limits are exceeded.
3—Maximum takeoff weight and takeoff forward CG limits are exceeded.

**5841.** (Refer to figures 47, 49, 50, and 51.) Where is the longitudinal CG located under Loading Condition BL-1?

1—Station 214.3.
2—Station 235.6.
3—Station 237.8.

**5842.** (Refer to figures 47, 49, 50, and 51.) Where is the longitudinal CG located under Loading Condition BL-2?

1—Station 237.6.
2—Station 238.5.
3—Station 262.3.

**5843.** (Refer to figures 47, 49, 50, and 51.) Where is the longitudinal CG located under Loading Condition BL-3?

1—Station 223.4.
2—Station 239.0.
3—Station 240.3.

**5844.** (Refer to figures 47, 49, 50, and 51.) Where is the longitudinal CG located under Loading Condition BL-4?

1—Station 238.1.
2—Station 220.4.
3—Station 236.5.

**5845.** (Refer to figures 47, 49, 50, and 51.) Where is the longitudinal CG located under Loading Condition BL-5?

1—Station 232.0.
2—Station 235.4.
3—Station 234.9.

**5846.** (Refer to figures 47, 49, 50, and 51.) What is the CG shift if all passengers in row 1 are moved to row 4 under Loading Condition BL-1?

1—5.0 inches aft.
2—4.1 inches aft.
3—0.19 inch aft.

**5847.** (Refer to figures 47, 49, 50, and 51.) What is the CG shift if one passenger weighing 150 pounds in row 2 is moved to row 4 under Loading Condition BL-2?

1—0.1 inch aft.
2—0.6 inch aft.
3—1.1 inches aft.

**5848.** (Refer to figures 47, 49, 50, and 51.) What is the CG shift if all passengers in row 4 are moved to row 1 under Loading Condition BL-3?

1—3.7 inches forward.
2—0.4 inch forward.
3—3.9 inches forward.

**5849.** (Refer to figures 47, 49, 50, and 51.) What is the CG shift if the passengers in row 1 are moved to row 4 under Loading Condition BL-4?

1—1.1 inches aft.
2—1.6 inches aft.
3—0.2 inch aft.

**5850.** (Refer to figures 47, 49, 50, and 51.) What is the CG shift if one passenger, weighing 100 pounds seated in row 1 is moved to row 3, under Loading Condition BL-5?

1—1.0 inch aft.
2—0.4 inch aft.
3—1.3 inches aft.

**5851.** (Refer to figures 48, 50, 51, and 53.) What limits are exceeded under Loading Condition BL-6?

1—Aft CG limits are exceeded at takeoff and landing.
2—Takeoff aft CG and landing forward CG limits are exceeded.
3—Maximum takeoff weight and takeoff aft CG limits are exceeded.

**5852.** (Refer to figures 48, 50, 51, and 53.) What limit, if any, is exceeded under Loading Condition BL-7?

1—No limits are exceeded.
2—Forward CG limit is exceeded at landing only.
3—Forward CG limit is exceeded at takeoff and landing.

**5853.** (Refer to figures 48, 50, 51, and 53.) What limit, if any, is exceeded under Loading Condition BL-8?

1—No limits are exceeded.
2—Forward CG limit is exceeded at landing only.
3—Forward CG limit is exceeded at takeoff and landing.

**5854.** (Refer to figures 48, 50, 51, and 53.) What limit, if any, is exceeded under Loading Condition BL-9?

1—No limits are exceeded.
2—Aft CG limit is exceeded at takeoff only.
3—Aft CG limit is exceeded at takeoff and landing.

**5855.** (Refer to figures 48, 50, 51, and 53.) What limit, if any, is exceeded under Loading Condition BL-10?

1—No limits are exceeded.
2—Aft CG limit is exceeded at takeoff.
3—Forward CG limit is exceeded at landing.

**5856.** (Refer to figures 48, 49, 50, 51, and 52.) Given Loading Condition BL-6, what is the effect on lateral CG if the outside passengers from each row on the left side are deplaned? Deplaned passenger weights are 170 pounds each.

1—CG shifts 1.5 inches right, out of limits.
2—CG shifts 1.4 inches right, within limits.
3—CG shifts 1.6 inches left, out of limits.

**5857.** (Refer to figures 48, 49, 50, 51, and 52.) Given Loading Condition BL-7, what is the effect on lateral CG if additional passengers, each weighing 200 pounds, are seated, one in each outside right seat of rows 1, 2, 3, and 4?

1—CG shifts 1.5 inches left, out of limits.
2—CG shifts 0.2 inch right, within limits.
3—CG shifts 1.8 inches right, out of limits.

**5858.** (Refer to figures 48, 49, 50, 51, and 52.) Given Loading Condition BL-8, what is the effect on lateral CG if a passenger weighing 200 pounds is added to the outer left seat of row 1, and a passenger weighing 220 pounds is added to the outer left seat of row 4?

1—CG shifts 1.5 inches left, out of limits.
2—CG shifts 1.2 inches left, within limits.
3—CG shifts 1.0 inch left, within limits.

**5859.** (Refer to figures 48, 49, 50, 51, and 52.) Given Loading Condition BL-9, what is the effect on lateral CG if passengers, each weighing 160 pounds, are added to the outer left seats of rows 1 and 2; and passengers, each weighing 180 pounds are added to the outer right seats of rows 3 and 4?

1—CG shifts 0.14 inch left.
2—CG shifts 0.15 inch right.
3—CG does not shift.

**5860.** (Refer to figures 48, 49, 50, 51, and 52.) Given Loading Condition BL-10, what is the effect on lateral CG if a passenger, weighing 240 pounds, is shifted from the outer right seat of row 4 to the outer left seat of row 1?

1—CG shifts 1.1 inches left, within limits.
2—CG shifts 1.5 inches left, out of limits.
3—CG shifts 1.7 inches left, out of limits.

**5861.** (Refer to figures 54, 55, and 56.) What are $V_1$ and $V_R$ speeds for Operating Conditions A-1?

1—$V_1$ 123.1 knots; $V_R$ 125.2 knots.
2—$V_1$ 120.5 knots; $V_R$ 123.5 knots.
3—$V_1$ 122.3 knots; $V_R$ 124.1 knots.

**5862.** (Refer to figures 54, 55, and 56.) What are $V_1$ and $V_R$ speeds for Operating Condition A-2?

1—$V_1$ 129.7 knots; $V_R$ 134.0 knots.
2—$V_1$ 127.2 knots; $V_R$ 133.2 knots.
3—$V_1$ 127.4 knots; $V_R$ 133.6 knots.

**5863.** (Refer to figures 54, 55, and 56.) What are $V_1$ and $V_R$ speeds for Operating Condition A-3?

1—$V_1$ 136.8 knots; $V_R$ 141.8 knots.
2—$V_1$ 134.8 knots; $V_R$ 139.0 knots.
3—$V_1$ 133.5 knots; $V_R$ 141.0 knots.

**5864.** (Refer to figures 54, 55, and 56.) What are $V_1$ and $V_R$ speeds for Operating Condition A-4?

1—$V_1$ 128.0 knots; $V_R$ 130.5 knots.
2—$V_1$ 129.9 knots; $V_R$ 133.4 knots.
3—$V_1$ 128.6 knots; $V_R$ 131.1 knots.

**5865.** (Refer to figures 54, 55, and 56.) What are $V_1$ and $V_R$ speeds for Operating Condition A-5?

1—$V_1$ 110.4 knots; $V_R$ 110.9 knots.
2—$V_1$ 109.6 knots; $V_R$ 112.7 knots.
3—$V_1$ 106.4 knots; $V_R$ 106.4 knots.

**5866.** (Refer to figure 55.) What is the STAB TRIM setting for Operating Condition A-1?

1—29 percent MAC.
2—32 percent MAC.
3—36 percent MAC.

**5867.** (Refer to figure 55.) What is the STAB TRIM setting for Operating Condition A-2?

1—26 percent MAC.
2—20 percent MAC.
3—22 percent MAC.

**5868.** (Refer to figure 55.) What is the STAB TRIM setting for Operating Condition A-3?

1—18 percent MAC.
2—20 percent MAC.
3—22 percent MAC.

**5869.** (Refer to figure 55.) What is the STAB TRIM setting for Operating Condition A-4?

1—26 percent MAC.
2—22 percent MAC.
3—18 percent MAC.

**5870.** (Refer to figure 55.) What is the STAB TRIM setting for Operating Condition A-5?

1—26 percent MAC.
2—30 percent MAC.
3—32 percent MAC.

**5871.** (Refer to figures 54, 57, and 58.) What is the max takeoff EPR for Operating Condition G-1?

1—Engines 1 and 3, 2.22; engine 2, 2.16.
2—Engines 1 and 3, 2.22; engine 2, 2.21.
3—Engines 1 and 3, 2.15; engine 2, 2.09.

**5872.** (Refer to figures 54, 57, and 58.) What is the max takeoff EPR for Operating Condition G-2?

1—Engines 1 and 3, 2.15; engine 2, 2.16.
2—Engines 1 and 3, 2.18; engine 2, 2.13.
3—Engines 1 and 3, 2.14; engine 2, 2.11.

**5873.** (Refer to figures 54, 57, and 58.) What is the max takeoff EPR for Operating Condition G-3?

1—Engines 1 and 3, 2.08; engine 2, 2.05.
2—Engines 1 and 3, 2.14; engine 2, 2.10.
3—Engines 1 and 3, 2.18; engine 2, 2.07.

**5874.** (Refer to figures 54, 57, and 58.) What is the max takeoff EPR for Operating Condition G-4?

1—Engines 1 and 3, 2.23; engine 2, 2.21.
2—Engines 1 and 3, 2.26; engine 2, 2.25.
3—Engines 1 and 3, 2.24; engine 2, 2.24.

**5875.** (Refer to figures 54, 57, and 58.) What is the max takeoff EPR for Operating Condition G-5?

1—Engines 1 and 3, 2.27; engine 2, 2.18.
2—Engines 1 and 3, 2.16; engine 2, 2.14.
3—Engines 1 and 3, 2.23; engine 2, 2.22.

**5876.** (Refer to figures 54, 57, and 58.) What is the takeoff safety speed for Operating Condition G-1?

1—122 knots.
2—137 knots.
3—133 knots.

**5877.** (Refer to figures 54, 57, and 58.) What is the rotation speed for Operating Condition G-2?

1—150 knots.
2—154 knots.
3—155 knots.

**5878.** (Refer to figures 54, 57, and 58.) What are $V_1$, $V_R$, and $V_2$ speeds for Operating Condition G-3?

1—134, 134, and 145 knots.
2—134, 139, and 145 knots.
3—132, 132, and 145 knots.

**5879.** (Refer to figures 54, 57, and 58.) What are $V_1$ and $V_2$ speeds for Operating Condition G-4?

1—133 and 145 knots.
2—127 and 141 knots.
3—132 and 146 knots.

**5880.** (Refer to figures 54, 57, and 58.) What are rotation and $V_2$ bug speeds for Operating Condition G-5?

1—120 and 134 knots.
2—119 and 135 knots.
3—135 and 135 knots.

**5881.** (Refer to figures 57 and 58.) What is the STAB TRIM setting for Operating Condition G-1?

1—4 ANU.
2—4-1/2 ANU.
3—4-3/4 ANU.

**5882.** (Refer to figures 57 and 58.) What is the STAB TRIM setting for Operating Condition G-2?

1—6-1/2 ANU.
2—7-1/4 ANU.
3—5-3/4 ANU.

**5883.** (Refer to figures 57 and 58.) What is the STAB TRIM setting for Operating Condition G-3?

1—3-3/4 ANU.
2—4 ANU.
3—4-1/4 ANU.

**5884.** (Refer to figures 57 and 58.) What is the STAB TRIM setting for Operating Condition G-4?

1—2-3/4 ANU.
2—4 ANU.
3—2-1/2 ANU.

**5885.** (Refer to figures 57 and 58.) What is the STAB TRIM setting for Operating Condition G-5?

1—3-1/4 ANU.
2—2-3/4 ANU.
3—2-1/2 ANU.

**5886.** (Refer to figures 54, 59, and 61.) What is the takeoff EPR for Operating Condition R-1?

1—2.04.
2—2.00.
3—2.01.

**5887.** (Refer to figures 54, 59, and 61.) What is the takeoff EPR for Operating Condition R-2?

1—2.16.
2—2.19.
3—2.18.

**5888.** (Refer to figures 54, 59, and 61.) What is the takeoff EPR for Operating Condition R-3?

1—2.01.
2—2.06.
3—2.04.

**5889.** (Refer to figures 54, 59, and 61.) What is the takeoff EPR for Operating Condition R-4?

1—2.08.
2—2.06.
3—2.11.

**5890.** (Refer to figures 54, 59, and 61.) What is the takeoff EPR for Operating Condition R-5?

1—1.98.
2—1.95.
3—1.96.

**5891.** (Refer to figures 54, 59, and 61.) What is the takeoff safety speed for Operating Condition R-1?

1—128 knots.
2—121 knots.
3—133 knots.

**5892.** (Refer to figures 54, 59, and 61.) What is the rotation speed for Operating Condition R-2?

1—147 knots.
2—152 knots.
3—146 knots.

**5893.** (Refer to figures 54, 59. and 61.) What are $V_1$, $V_R$, and $V_2$ speeds for Operating Condition R-3?

1—143, 143, and 147 knots.
2—138, 138, and 142 knots.
3—136, 138, and 143 knots.

**5894.** (Refer to figures 54, 59, and 61.) What are critical engine failure and takeoff safety speeds for Operating Condition R-4?

1—131 and 133 knots.
2—123 and 134 knots.
3—122 and 130 knots.

**5895.** (Refer to figures 54, 59, and 61.) What are rotation and $V_2$ bug speeds for Operating Condition R-5?

1—138 and 143 knots.
2—136 and 138 knots.
3—134 and 141 knots.

**5896.** (Refer to figures 59 and 61.) What is the STAB TRIM setting for Operating Condition R-1?

1—8 ANU.
2—7-5/8 ANU.
3—7-3/4 ANU.

**5897.** (Refer to figures 59 and 61.) What is the STAB TRIM setting for Operating Condition R-2?

1—5-3/4 ANU.
2—7 ANU.
3—6-3/4 ANU.

**5898.** (Refer to figures 59 and 61.) What is the STAB TRIM setting for Operating Condition R-3?

1—3 ANU.
2—4-1/2 ANU.
3—5 ANU.

**5899.** (Refer to figures 59 and 61.) What is the STAB TRIM setting for Operating Condition R-4?

1—4-1/4 ANU.
2—4-1/2 ANU.
3—5 ANU.

**5900.** (Refer to figures 59 and 61.) What is the STAB TRIM setting for Operating Condition R-5?

1—6-3/4 ANU.
2—8 ANU.
3—7-1/2 ANU.

**5901.** (Refer to figures 60, 62, and 63.) What is the ground distance covered during en route climb for Operating Condition V-1?

1—145 miles.
2—137 miles.
3—134 miles.

**5902.** (Refer to figures 60, 62, and 63.) What is the ground distance covered during en route climb for Operating Condition V-2?

1—84 miles.
2—65 miles.
3—69 miles.

**5903.** (Refer to figures 60, 62, and 63.) What is the ground distance covered during en route climb for Operating Condition V-3?

1—95 miles.
2—79 miles.
3—57 miles.

**5904.** (Refer to figures 60, 62, and 63.) What is the ground distance covered during en route climb for Operating Condition V-4?

1—63 miles.
2—53 miles.
3—65 miles.

**5905.** (Refer to figures 60, 62, and 63.) What is the ground distance covered during en route climb for Operating Condition V-5?

1—70 miles.
2—47 miles.
3—61 miles.

**5906.** (Refer to figures 60, 62, and 63.) How much fuel is burned during en route climb for Operating Condition V-1?

1—4,100 pounds.
2—3,600 pounds.
3—4,000 pounds.

**5907.** (Refer to figures 60, 62, and 63.) How much fuel is burned during en route climb for Operating Condition V-2?

1—2,250 pounds.
2—2,600 pounds.
3—2,400 pounds.

**5908.** (Refer to figures 60, 62, and 63.) What is the aircraft weight at the top of climb for Operating Condition V-3?

1—82,100 pounds.
2—82,500 pounds.
3—82,200 pounds.

**5909.** (Refer to figures 60, 62, and 63.) What is the aircraft weight at the top of climb for Operating Condition V-4?

1—102,900 pounds.
2—102,600 pounds.
3—103,100 pounds.

**5910.** (Refer to figures 60, 62, and 63.) What is the aircraft weight at the top of climb for Operating Condition V-5?

1—73,000 pounds.
2—72,900 pounds.
3—72,800 pounds.

**5911.** (Refer to figures 64 and 66.) What is the max climb EPR for Operating Conditions T-1?

1—1.96.
2—2.04.
3—1.90.

**5912.** (Refer to figures 64 and 66.) What is the max continuous EPR for Operating Condition T-2?

1—2.10.
2—1.99.
3—2.02.

**5913.** (Refer to figures 64 and 66.) What is the max cruise EPR for Operating Condition T-3?

1—2.11.
2—2.02.
3—1.90.

**5914.** (Refer to figures 64 and 66.) What is the max climb EPR for Operating Condition T-4?

1—2.20.
2—2.07.
3—2.06.

**5915.** (Refer to figures 64 and 66.) What is the max continuous EPR for Operating Condition T-5?

1—2.00.
2—2.04.
3—1.96.

**5916.** (Refer to figures 65, 67, and 68.) What is the ground distance covered during en route climb for Operating Condition W-1?

1—104.0 miles.
2—99.2 miles.
3—109.7 miles.

**5917.** (Refer to figures 65, 67, and 68.) What is the ground distance covered during en route climb for Operating Condition W-2?

1—85.8 miles.
2—87.8 miles.
3—79.4 miles.

**5918.** (Refer to figures 65, 67, and 68.) What is the ground distance covered during en route climb for Operating Condition W-3?

1—86.4 miles.
2—84.2 miles.
3—85.1 miles.

**5919.** (Refer to figures 65, 67, and 68.) What is the ground distance covered during en route climb for Operating Condition W-4?

1—58.4 miles.
2—61.4 miles.
3—60.3 miles.

**5920.** (Refer to figures 65, 67, and 68.) What is the ground distance covered during en route climb for Operating Condition W-5?

1—68.0 miles.
2—73.9 miles.
3—66.4 miles.

**5921.** (Refer to figures 65, 67, and 68.) What is the aircraft weight at the top of climb for Operating Condition W-1?

1—81,600 pounds.
2—81,400 pounds.
3—81,550 pounds.

**5922.** (Refer to figures 65, 67, and 68.) What is the aircraft weight at the top of climb for Operating Condition W-2?

1—82,775 pounds.
2—83,650 pounds.
3—83,800 pounds.

**5923.** (Refer to figures 65, 67, and 68.) What is the aircraft weight at the top of climb for Operating Condition W-3?

1—75,750 pounds.
2—75,900 pounds.
3—76,100 pounds.

**5924.** (Refer to figures 65, 67, and 68.) What is the aircraft weight at the top of climb for Operating Condition W-4?

1—86,150 pounds.
2—86,260 pounds.
3—86,450 pounds.

**5925.** (Refer to figures 65, 67, and 68.) What is the aircraft weight at the top of climb for Operating Condition W-5?

1—89,900 pounds.
2—90,000 pounds.
3—90,100 pounds.

**5926.** (Refer to figures 69 and 71.) What is the trip time for Operating Condition X-1?

1—4 hours 5 minutes.
2—4 hours 15 minutes.
3—4 hours.

**5927.** (Refer to figures 69 and 71.) What is the trip time for Operating Condition X-2?

1—5 hours 5 minutes.
2—6 hours 15 minutes.
3—5 hours 55 minutes.

**5928.** (Refer to figures 69 and 71.) What is the trip time for Operating Condition X-3?

1—4 hours 15 minutes.
2—3 hours 40 minutes.
3—4 hours.

**5929.** (Refer to figures 69 and 71.) What is the trip time for Operating Condition X-4?

1—6 hours 50 minutes.
2—5 hours 45 minutes.
3—5 hours 30 minutes

**5930.** (Refer to figures 69 and 71.) What is the trip time for Operating Condition X-5?

1—2 hours 55 minutes.
2—3 hours 10 minutes.
3—2 hours 50 minutes.

**5931.** (Refer to figures 69 and 71.) What is the trip fuel for Operating Condition X-1?

1—25,000 pounds.
2—26,000 pounds.
3—24,000 pounds.

**5932.** (Refer to figures 69 and 71.) What is the trip fuel for Operating Condition X-2?

1—33,000 pounds.
2—28,000 pounds.
3—35,000 pounds.

**5933.** (Refer to figures 69 and 71.) What is the trip fuel for Operating Condition X-3?

1—36,000 pounds.
2—34,500 pounds.
3—33,000 pounds.

**5934.** (Refer to figures 69 and 71.) What is the trip fuel for Operating Condition X-4?

1—33,000 pounds.
2—31,500 pounds.
3—34,000 pounds.

**5935.** (Refer to figures 69 and 71.) What is the trip fuel for Operating Condition X-5?

1—15,000 pounds.
2—20,000 pounds.
3—19,000 pounds.

**5936.** (Refer to figures 70 and 73.) What is the turbulent air penetration $N_1$ power setting for Operating Condition Q-1?

1—82.4 percent.
2—84.0 percent.
3—84.8 percent.

**5937.** (Refer to figures 70 and 73.) What is the turbulent air penetration $N_1$ power setting for Operating Condition Q-2?

1—78.2 percent.
2—75.2 percent.
3—76.7 percent.

**5938.** (Refer to figures 70 and 73.) What is the turbulent air penetration $N_1$ power setting for Operating Condition Q-3?

1—77.8 percent.
2—82.6 percent.
3—84.2 percent.

**5939.** (Refer to figures 70 and 73.) What is the turbulent air penetration $N_1$ power setting for Operating Condition Q-4?

1—76.8 percent.
2—75.4 percent.
3—74.0 percent.

**5940.** (Refer to figures 70 and 73.) What is the Turbulent air penetration $N_1$ power setting for Operating Condition Q-5?

1—70.9 percent.
2—72.9 percent.
3—71.6 percent.

**5941.** (Refer to figures 72 and 74.) What is the trip time corrected for wind under Operating Condition Z-1?

1—58.1 minutes.
2—51.9 minutes.
3—54.7 minutes.

**5942.** (Refer to figures 72 and 74.) What is the trip time corrected for wind under Operating Condition Z-2?

1—1 hour 35 minutes.
2—1 hour 52 minutes.
3—1 hour 46 minutes.

**5943.** (Refer to figures 72 and 74.) What is the trip time corrected for wind under Operating Condition Z-3?

1—2 hours 9 minutes.
2—1 hour 59 minutes.
3—1 hour 52 minutes.

**5944.** (Refer to figures 72 and 74.) What is the trip time corrected for wind under Operating Condition Z-4?

1—48.3 minutes.
2—50.7 minutes.
3—51.3 minutes.

**5945.** (Refer to figures 72 and 74.) What is the trip time corrected for wind under Operating Condition Z-5?

1—1 hour 11 minutes.
2—56 minutes.
3—62 minutes.

**5946.** (Refer to figures 72 and 74.) What is the estimated fuel consumption for Operating Condition Z-1?

1—5,230 pounds.
2—5,970 pounds.
3—5,550 pounds.

**5947.** (Refer to figures 72 and 74.) What is the estimated fuel consumption for Operating Condition Z-2?

1—10,270 pounds.
2—9,660 pounds.
3—10,165 pounds.

**5948.** (Refer to figures 72 and 74.) What is the estimated fuel consumption for Operating Condition Z-3?

1—12,300 pounds.
2—11,300 pounds.
3—13,990 pounds.

**5949.** (Refer to figures 72 and 74.) What is the estimated fuel consumption for Operating Condition Z-4?

1—4,950 pounds.
2—5,380 pounds.
3—5,230 pounds.

**5950.** (Refer to figures 72 and 74.) What is the estimated fuel consumption for Operating Condition Z-5?

1—6,250 pounds.
2—5,380 pounds.
3—7,120 pounds.

**5951.** (Refer to figures 75 and 78.) What is the total time from starting to the alternate through completing the approach for Operating Condition L-1?

1—30 minutes.
2—45 minutes.
3—29 minutes.

**5952.** (Refer to figures 75 and 78.) What is the total time from starting to the alternate through completing the approach for Operating Condition L-2?

1—36 minutes.
2—51 minutes.
3—40 minutes.

**5953.** (Refer to figures 75 and 78.) What is the total time from starting to the alternate through completing the approach for Operating Condition L-3?

1—1 hour.
2—1 hour 9 minutes.
3—1 hour 24 minutes.

**5954.** (Refer to figures 75 and 78.) What is the total time from starting to the alternate through completing the approach for Operating Condition L-4?

1—34 minutes.
2—19 minutes.
3—20 minutes.

**5955.** (Refer to figures 75 and 78.) What is the total time from starting to the alternate through completing the approach for Operating Condition L-5?

1—1 hour 10 minutes.
2—48 minutes.
3—55 minutes.

**5956.** (Refer to figures 75 and 78.) What is the approximate landing weight for Operating Condition L-1?

1—79,000 pounds.
2—83,500 pounds.
3—81,500 pounds.

**5957.** (Refer to figures 75 and 78.) What is the approximate landing weight for Operating Condition L-2?

1—65,200 pounds.
2—66,100 pounds.
3—69,600 pounds.

**5958.** (Refer to figures 75 and 78.) What is the approximate landing weight for Operating Condition L-3?

1—80,300 pounds.
2—85,400 pounds.
3—77,700 pounds.

**5959.** (Refer to figures 75 and 78.) What is the approximate landing weight for Operating Condition L-4?

1—73,300 pounds.
1—74,190 pounds.
3—73,500 pounds.

**5960.** (Refer to figures 75 and 78.) What is the approximate landing weight for Operating Condition L-5?

1—78,600 pounds.
2—77,000 pounds.
3—76,800 pounds.

**5961.** (Refer to figures 76 and 79.) What are the recommended IAS and EPR settings for holding under Operating Condition H-1?

1—264 knots and 1.80 EPR.
2—259 knots and 1.73 EPR.
3—261 knots and 1.81 EPR.

**5962.** (Refer to figures 76 and 79.) What are the recommended IAS and EPR settings for holding under Operating Condition H-2?

1—257 knots and 1.60 EPR.
2—258 knots and 1.66 EPR.
3—253 knots and 1.57 EPR.

**5963.** (Refer to figures 76 and 79.) What are the recommended IAS and EPR settings for holding under Operating Condition H-3?

1—226 knots and 1.30 EPR.
2—230 knots and 1.31 EPR.
3—234 knots and 1.32 EPR.

**5964.** (Refer to figures 76 and 79.) What are the recommended IAS and EPR settings for holding under Operating Condition H-4?

1—219 knots and 1.44 EPR.
2—216 knots and 1.42 EPR.
3—220 knots and l.63 EPR.

**5965.** (Refer to figures 76 and 79.) What are the recommended IAS and EPR settings for holding under Operating Condition H-5?

1—245 knots and 1.65 EPR.
2—237 knots and 1.61 EPR.
3—249 knots and 1.67 EPR.

**5966.** (Refer to figures 76 and 79.) What is the approximate fuel consumed when holding under Operating Condition H-1?

1—3,500 pounds.
2—4,680 pounds.
3—2,630 pounds.

**5967.** (Refer to figures 76 and 79.) What is the approximate fuel consumed when holding under Operating Condition H-2?

1—5,100 pounds.
2—3,400 pounds.
3—5,250 pounds.

**5968.** (Refer to figures 76 and 79.) What is the approximate fuel consumed when holding under Operating Condition H-3?

1—3,090 pounds.
2—6,950 pounds.
3—6,680 pounds.

**5969.** (Refer to figures 76 and 79.) What is the approximate fuel consumed when holding under Operating Condition H-4?

1—3,190 pounds.
2—3,050 pounds.
3—2,550 pounds.

**5970.** (Refer to figures 76 and 79.) What is the approximate fuel consumed when holding under Operating Condition H-5?

1—3,170 pounds.
2—7,380 pounds.
3—5,540 pounds.

**5971.** (Refer to figures 77 and 80.) What are the recommended IAS and EPR settings for holding under Operating Condition O-1?

1—221 knots and 1.83 EPR.
2—223 knots and 2.01 EPR.
3—217 knots and 1.81 EPR.

**5972.** (Refer to figures 77 and 80.) What are the recommended IAS and EPR settings for holding under Operating Condition O-2?

1—210 knots and 1.57 EPR.
2—210 knots and 1.51 EPR.
3—210 knots and 1.45 EPR.

**5973.** (Refer to figures 77 and 80.) What are the recommended IAS and EPR settings for holding under Operating Condition O-3?

1—217 knots and 1.50 EPR.
2—215 knots and 1.44 EPR.
3—216 knots and 1.40 EPR.

**5974.** (Refer to figures 77 and 80.) What are the recommended IAS and EPR settings for holding under Operating Condition O-4?

1—223 knots and 1.33 EPR.
2—225 knots and 1.33 EPR.
3—220 knots and 1.28 EPR.

**5975.** (Refer to figures 77 and 80.) What are the recommended IAS and EPR settings for holding under Operating Condition O-5?

1—219 knots and 1.28 EPR.
2—214 knots and 1.26 EPR.
3—218 knots and 1.27 EPR.

**5976.** (Refer to figures 77 and 80.) What is the approximate fuel consumed when holding under Operating Condition O-1?

1—1,625 pounds.
2—1,950 pounds.
3—2,440 pounds.

**5977.** (Refer to figures 77 and 80.) What is the approximate fuel consumed when holding under Operating Condition O-2?

1—2,250 pounds.
2—2,500 pounds.
3—3,000 pounds.

**5978.** (Refer to figures 77 and 80.) What is the approximate fuel consumed when holding under Operating Condition O-3?

1—2,940 pounds.
2—2,520 pounds.
3—3,250 pounds.

**5979.** (Refer to figures 77 and 80.) What is the approximate fuel consumed when holding under Operating Condition O-4?

1—2,870 pounds.
2—2,230 pounds.
3—1,440 pounds.

**5980.** (Refer to figures 77 and 80.) What is the approximate fuel consumed when holding under Operating Condition O-5?

1—2,950 pounds.
2—2,870 pounds.
3—2,400 pounds.

**5981.** (Refer to figure 81.) How many minutes of dump time is required to reach a weight of 144,500 pounds?

| | |
|---|---|
| Initial Weight | 180,500 lb |
| Zero Fuel Weight | 125,500 lb |

1—13 minutes.
2—15 minutes.
3—16 minutes.

**5982.** (Refer to figure 81.) How many minutes of dump time is required to reduce fuel load to 25,000 pounds?

| | |
|---|---|
| Initial Weight | 179,500 lb |
| Zero Fuel Weight | 136,500 lb |

1—10 minutes.
2—9 minutes.
3—8 minutes.

**5983.** (Refer to figure 81.) How many minutes of dump time is required to reach a weight of 151,500 pounds?

| | |
|---|---|
| Initial Weight | 181,500 lb |
| Zero Fuel Weight | 126,000 lb |

1—15 minutes.
2—14 minutes.
3—13 minutes.

**5984.** (Refer to figure 81.) How many minutes of dump time is required to reduce fuel load to 16,000 pounds?

Initial Weight................................................................ 175,500 lb
Zero Fuel Weight........................................................ 138,000 lb

1—9 minutes.
2—10 minutes.
3—8 minutes.

**5985.** (Refer to figure 81.) How many minutes of dump time is required to reach a weight of 144,000 pounds?

Initial Weight................................................................ 178,000 lb
Zero Fuel Weight........................................................ 121,000 lb

1—15 minutes.
2—14 minutes.
3—13 minutes.

**5986.** (Refer to figures 82 and 84.) What is the approximate level-off pressure altitude after drift-down under Operating Condition D-1?

1—19,400 feet.
2—18,000 feet.
3—20,200 feet.

**5987.** (Refer to figures 82 and 84.) What is the approximate level-off pressure altitude after drift-down under Operating Condition D-2?

1—14,700 feet.
2—17,500 feet.
3—18,300 feet.

**5988.** (Refer to figures 82 and 84.) What is the approximate level-off pressure altitude after drift-down under Operating Condition D-3?

1—22,200 feet.
2—19,800 feet.
3—21,600 feet.

**5989.** (Refer to figures 82 and 84.) What is the approximate level-off pressure altitude after drift-down under Operating Condition D-4?

1—27,900 feet.
2—22,200 feet.
3—24,400 feet.

**5990.** (Refer to figures 82 and 84.) What is the approximate level-off pressure altitude after drift-down under Operating Condition D-5?

1—8,800 feet.
2—9,600 feet.
3—13,000 feet.

**5991.** (Refer to figures 83 and 85.) What are descent time and distance under Operating Condition S-1?

1—24 minutes, 118 NAM.
2—26 minutes, 125 NAM.
3—25 minutes, 118 NAM.

**5992.** (Refer to figures 83 and 85.) What are descent fuel and distance under Operating Condition S-2?

1—1,440 pounds, 104 NAM.
2—1,500 pounds, 118 NAM.
3—1,400 pounds, 98 NAM.

**5993.** (Refer to figures 83 and 85.) What are descent fuel and distance under Operating Condition S-3?

1—1,490 pounds, 118 NAM.
2—1,440 pounds, 110 NAM.
3—1,550 pounds, 127 NAM.

**5994.** (Refer to figures 83 and 85.) What are descent time and distance under Operating Condition S-4?

1—22 minutes, 110 NAM.
2—21 minutes, 113 NAM.
3—24 minutes, 129 NAM.

**5995.** (Refer to figures 83 and 85.) What are descent fuel and distance under Operating Condition S-5?

1—1,420 pounds, 97 NAM.
2—1,440 pounds, 102 NAM.
3—1,390 pounds, 92 NAM.

**5996.** (Refer to figures 86 and 87.) What is the go-around EPR for Operating Condition L-1?

1—1.98 EPR.
2—2.01 EPR.
3—2.00 EPR.

**5997.** (Refer to figures 86 and 87.) What is the go-around EPR for Operating Condition L-2?

1—2.15 EPR.
2—2.03 EPR.
3—2.06 EPR.

**5998.** (Refer to figures 86 and 87.) What is the go-around EPR for Operating Condition L-3?

1—2.03 EPR.
2—2.07 EPR.
3—2.05 EPR.

**5999.** (Refer to figures 86 and 87.) What is the go-around EPR for Operating Condition L-4?

1—2.05 EPR.
2—2.12 EPR.
3—2.09 EPR.

**6000.** (Refer to figures 86 and 87.) What is the go-around EPR for Operating Condition L-5?

1—2.00 EPR.
2—2.07 EPR.
3—2.04 EPR.

**6001.** (Refer to figures 86, 87, and 118.) What is $V_{REF}$ for Operating Condition L-1?

1—143 knots.
2—144 knots.
3—145 knots.

**6002.** (Refer to figures 86, 87, and 118.) What is reference speed For Operating Condition L-2?

1—140 knots.
2—145 knots.
3—148 knots.

**6003.** (Refer to figures 86, 87, and 118.) What is $V_{REF}+20$ for Operating Condition L-3?

1—151 knots.
2—169 knots.
3—149 knots.

**6004.** (Refer to figures 86, 87, and 118.) What is $V_{REF}+10$ for Operating Condition L-4?

1—152 knots.
2—138 knots.
3—148 knots.

**6005.** (Refer to figures 86, 87, and 118.) What is maneuvering speed for Operating Condition L-5?

1—124 knots.
2—137 knots.
3—130 knots.

**6006.** (Refer to figure 89.) Which of the following configurations will result in the shortest landing distance over a 50-foot obstacle to a wet runway?

1—Brakes and spoilers at 122,500 pounds gross weight.
2—Brakes and reversers at 124,000 pounds gross weight.
3—Brakes, spoilers and reversers at 131,000 pounds gross weight.

**6007.** (Refer to figures 88 and 89.) Which conditions will result in the shortest landing distance at a weight of 132,500 pounds?

1—Dry runway using brakes and reversers.
2—Dry runway using brakes and spoilers.
3—Wet runway using brakes, spoilers and reversers.

**6008.** (Refer to figure 90.) Which configuration will result in a landing distance of 5,900 feet over a 50-foot obstacle to an icy runway?

1—Use of three reversers at 131,000 pounds gross weight.
2—Use of brakes and spoilers at 125,000 pounds gross weight.
3—Use of three reversers at 133,000 pounds gross weight.

**6009.** (Refer to figure 88.) How much longer is the dry runway landing distance using brakes only compared to using brakes and reversers at 114,000 pounds gross weight?

1—1,150 feet.
2—500 feet.
3—300 feet.

**6010.** (Refer to figure 88.) How many feet will remain after landing on a 7,200-foot dry runway with spoilers inoperative at 118,000 pounds gross weight?

1—4,200 feet.
2—4,500 feet.
3—4,750 feet.

**6011.** (Refer to figure 90.) What is the transition distance when landing on an icy runway at a gross weight of 134,000 pounds?

1—400 feet.
2—950 feet.
3—1,350 feet.

**6012.** (Refer to figure 89.) How many feet will remain after landing on a 6,000-foot wet runway with reversers inoperative at 122,000 pounds gross weight?

1—2,200 feet.
2—2,750 feet.
3—3,150 feet.

**6013.** (Refer to figure 90.) What is the maximum landing weight which will permit stopping 500 feet short of the end of a 5,200-foot icy runway?

1—124,000 pounds.
2—137,000 pounds.
3—108,000 pounds.

**6014.** (Refer to figure 88.) What is the maximum landing weight which will permit stopping 2,000 feet short of the end of a 5,400-foot dry runway with reversers and spoilers inoperative?

1—117,500 pounds.
2—136,500 pounds.
3—139,500 pounds.

**6015.** (Refer to figure 90.) What is the landing distance on an icy runway with reversers inoperative at a landing weight of 125,000 pounds?

1—4,500 feet.
2—4,750 feet.
3—5,800 feet.

**6016.** (Refer to figure 91.) How much will landing distance be reduced by using 15° of flaps rather than 0° flaps at a landing weight of 119,000 pounds?

1—500 feet.
2—800 feet.
3—2,700 feet.

**6017.** (Refer to figure 91.) What is the ground roll when landing with 15° of flaps at a landing weight of 122,000 pounds?

1—1,750 feet.
2—2,200 feet.
3—2,750 feet.

**6018.** (Refer to figures 91 and 93.) What approach speed and ground roll will be needed when landing at a weight of 140,000 pounds if flaps are not used?

1—138 knots and 3,900 feet.
2—153 knots and 2,900 feet.
3—183 knots and 2,900 feet.

**6019.** (Refer to figure 91.) How much more runway will be used to land with 0° flaps rather than 15° of flaps at a landing weight of 126,000 pounds?

1—900 feet.
2—1,800 feet.
3—2,700 feet.

**6020.** (Refer to figures 91 and 93.) What approach speed and landing distance will be needed when landing at a weight of 140,000 pounds with 15° of flaps?

1—123 knots and 3,050 feet.
2—138 knots and 3,050 feet.
3—153 knots and 2,050 feet.

**6021.** (Refer to figure 92.) What is the maximum indicated airspeed available when maintaining a 3° glide slope at a weight of 110,000 pounds?

1—136 knots.
2—132 knots.
3—139 knots.

**6022.** (Refer to figure 93.) What is the maximum indicated airspeed available when maintaining a 3° glide slope at a weight of 140,000 pounds?

1—127 knots.
2—149 knots.
3—156 knots.

**6023.** (Refer to figure 93.) What is the thrust required to maintain a 3° glide slope at 140,000 pounds, with gear down, flaps 30°, and an airspeed of $V_{REF}$ +30 knots?

1—13,300 pounds.
2—16,200 pounds.
3—17,700 pounds.

**6024.** (Refer to figure 92.) What is the thrust required to maintain a 3° glide slope at 110,000 pounds, with gear down, flaps 30°, and an airspeed of $V_{REF}$ +20 knots?

1—9,800 pounds.
2—11,200 pounds.
3—17,000 pounds.

**6025.** (Refer to figure 92.) What thrust is required to maintain level flight at 110,000 pounds, with gear down, flaps 40°, and an airspeed of 118 knots.

1—17,000 pounds.
2—20,800 pounds.
3—22,300 pounds.

**6026.** (Refer to figure 93.) What thrust is required to maintain level flight at 140,000 pounds, with gear up, flaps 25°, and an airspeed of 172 knots?

1—13,700 pounds.
2—18,600 pounds.
3—22,000 pounds.

**6027.** (Refer to figure 92.) What thrust is required to maintain level flight at 110,000 pounds, with gear up, flaps 25°, and an airspeed of 152 knots?

1—14,500 pounds.
2—15,900 pounds.
3—16,700 pounds.

**6028.** (Refer to figure 93.) What thrust is required to maintain level flight at 140,000 pounds, with gear down, flaps 25°, and an airspeed of 162 knots?

1—17,400 pounds.
2—19,500 pounds.
3—22,200 pounds.

**6029.** (Refer to figure 93.) What thrust is required to maintain level flight at 140,000 pounds, with gear down, flaps 25°, and an airspeed of 145 knots?

1—16,500 pounds.
2—18,100 pounds.
3—18,500 pounds.

**6030.** (Refer to figure 93.) What is the change of total drag for a 140,000 pound airplane when configuration is changed from flaps 30°, gear down, to flaps 0°, gear up, at a constant airspeed of 160 knots?

1—13,500 pounds.
2—13,300 pounds.
3—15,300 pounds.

**6031.** (Refer to figure 94.) Given the following conditions, what is the minimum torque for takeoff?

Pressure altitude.............................................................. 9,000 ft
Temperature (OAT)............................................................ +3° C
Ice vanes....................................................................Extended

1—3,100 ft-lb.
2—3,040 ft-lb.
3—3,180 ft-lb.

**6032.** (Refer to figure 94.) Given the following conditions, what is the minimum torque for takeoff?

Pressure altitude.............................................................. 7,500 ft
Temperature (OAT)............................................................ +35° C
Ice vanes....................................................................Retracted

1—2,820 ft-lb.
2—2,880 ft-lb.
3—2,780 ft-lb.

**6033.** (Refer to figure 94.) Given the following conditions, what is the minimum torque for takeoff?

| | |
|---|---|
| Pressure altitude | 7,500 ft |
| Temperature (OAT) | +9° C |
| Ice vanes | Extended |

1—3,200 ft-lb.
2—3,160 ft-lb.
3—3,300 ft-lb.

**6034.** (Refer to figure 94.) Given the following conditions, what is the minimum torque for takeoff?

| | |
|---|---|
| Pressure altitude | 3,500 ft |
| Temperature (OAT) | +43° C |
| Ice vanes | Retracted |

1—3,000 ft-lb.
2—3,050 ft-lb.
3—3,110 ft-lb.

**6035.** (Refer to figure 94.) Given the following conditions, what is the minimum torque for takeoff?

| | |
|---|---|
| Pressure altitude | 5,500 ft |
| Temperature (OAT) | +29° C |
| Ice vanes | Retracted |

1—2,950 ft-lb.
2—3,100 ft-lb.
3—3,200 ft-lb.

**6036.** (Refer to figure 95.) Given the following conditions, what is the takeoff distance over a 50-foot obstacle?

| | |
|---|---|
| Pressure altitude | Sea Level |
| Temperature (OAT) | +12° C |
| Weight | 16,000 lb |
| Wind component | 16 kts HW |
| Ice vanes | Retracted |

1—1,750 feet.
2—2,800 feet.
3—2,550 feet.

**6037.** (Refer to figure 95.) Given the following conditions, what is the takeoff ground roll and $V_1$ speed?

| | |
|---|---|
| Pressure altitude | 4,000 ft |
| Temperature (OAT) | 0° C |
| Weight | 15,500 lb |
| Wind component | 10 kts TW |
| Ice vanes | Extended |

1—2,900 feet, 106 knots.
2—4,250 feet, 102 knots.
3—2,700 feet, 107 knots.

**6038.** (Refer to figure 95.) Given the following conditions, what is the takeoff distance over a 50-foot obstacle?

| | |
|---|---|
| Pressure altitude | 2,000 ft |
| Temperature (OAT) | +15° C |
| Weight | 16,600 lb |
| Wind component | Calm |
| Ice vanes | Retracted |

1—3,400 feet.
2—3,700 feet.
3—4,200 feet.

**6039.** (Refer to figure 95.) Given the following conditions, what is the takeoff ground roll and $V_1$ speed?

| | |
|---|---|
| Pressure altitude | 3,000 ft |
| Temperature (OAT) | -10° C |
| Weight | 15,000 lb |
| Wind component | 8 kts TW |
| Ice vanes | Extended |

1—2,200 feet, 105 knots.
2—2,000 feet, 113 knots.
3—1,900 feet, 103 knots.

**6040.** (Refer to figure 95.) Given the following conditions, what is the takeoff distance over a 50-foot obstacle?

| | |
|---|---|
| Pressure altitude | 6,000 ft |
| Temperature (OAT) | +35° C |
| Weight | 14,500 lb |
| Wind component | 10 kts HW |
| Ice vanes | Retracted |

1—4,150 feet.
2—4,550 feet.
3—2,600 feet.

**6041.** (Refer to figure 96.) Given the following conditions, what is the accelerate-stop field length?

| | |
|---|---|
| Pressure altitude | 5,000 ft |
| Temperature (OAT) | +20° C |
| Weight | 15,000 lb |
| Wind component | 10 kts HW |
| Ice vanes | Retracted |

1—6,300 feet.
2—4,700 feet.
3—4,300 feet.

**6042.** (Refer to figure 96.) Given the following conditions, what is the accelerate-stop field length?

| | |
|---|---|
| Pressure altitude | 2,000 ft |
| Temperature (OAT) | -15° C |
| Weight | 16,000 lb |
| Wind component | 5 kts TW |
| Ice vanes | Extended |

1—3,750 feet.
2—4,600 feet.
3—4,250 feet.

**6043.** (Refer to figure 96.) Given the following conditions, what is the accelerate-stop field length?

| | |
|---|---|
| Pressure altitude | 6,000 ft |
| Temperature (OAT) | +10° C |
| Weight | 16,600 lb |
| Wind component | 15 kts HW |
| Ice vanes | Retracted |

1—4,950 feet.
2—4,800 feet.
3—5,300 feet.

**6044.** (Refer to figure 96.) Given the following conditions, what is the accelerate-stop field length?

| | |
|---|---|
| Pressure altitude | 8,000 ft |
| Temperature (OAT) | -5° C |
| Weight | 14,000 lb |
| Wind component | 4 kts TW |
| Ice vanes | Extended |

1—4,500 feet.
2—4,800 feet.
3—5,300 feet.

**6045.** (Refer to figure 96.) Given the following conditions, what is the accelerate-stop field length?

| | |
|---|---|
| Pressure altitude | Sea Level |
| Temperature (OAT) | +30° C |
| Weight | 13,500 lb |
| Wind component | 14 kts HW |
| Ice vanes | Retracted |

1—2,500 feet.
2—2,850 feet.
3—3,050 feet.

**6046.** (Refer to figures 97, 98, and 99.) What is the two-engine rate of climb after takeoff in climb configuration for Operating Condition B-21?

1—1,350 ft/min.
2—2,450 ft/min.
3—2,300 ft/min.

**6047.** (Refer to figures 97, 98, and 99.) What is the single-engine climb gradient after takeoff in climb configuration for Operating Condition B-22?

1—6.8 percent gradient.
2—7.5 percent gradient.
3—5.6 percent gradient.

**6048.** (Refer to figures 97, 98, and 99.) What is the two-engine rate of climb after takeoff in climb configuration for Operating Condition B-23?

1—1,500 ft/min.
2—2,600 ft/min.
3—2,490 ft/min.

**6049.** (Refer to figures 97, 98, and 99.) What is the two-engine rate of climb after takeoff in climb configuration for Operating Condition B-24?

1—2,100 ft/min.
2—2,400 ft/min.
3—1,500 ft/min.

**6050.** (Refer to figures 97, 98, and 99.) What is the single-engine rate of climb after takeoff in climb configuration for Operating Condition B-25?

1—385 ft/min.
2—780 ft/min.
3—665 ft/min.

**6051.** (Refer to figures 97 and 100.) What are the time, fuel, and distance from the start of climb to cruise altitude for Operating Condition B-21?

1—10.0 minutes; 290 pounds; 35 NAM.
2—10.0 minutes; 165 pounds; 30 NAM.
3—11.5 minutes; 165 pounds; 30 NAM.

**6052.** (Refer to figures 97 and 100.) What are the time, fuel, and distance from the start of climb to cruise altitude for Operating Condition B-22?

1—12.0 minutes; 220 pounds; 40 NAM.
2—11.0 minutes; 185 pounds; 37 NAM.
3—10.5 minutes; 175 pounds; 32 NAM.

**6053.** (Refer to figures 97 and 100.) What are the time, fuel, and distance from the start of climb to cruise altitude for Operating Condition B-23?

1—13.0 minutes; 180 pounds; 35 NAM.
2—14.0 minutes; 210 pounds; 40 NAM.
3—15.0 minutes; 240 pounds; 46 NAM.

**6054.** (Refer to figures 97 and 100.) What are the time, fuel, and distance from the start of climb to cruise altitude for Operating Condition B-24?

1—12.0 minutes; 220 pounds; 45 NAM.
2—9.0 minutes; 185 pounds; 38 NAM.
3—10.0 minutes; 170 pounds; 30 NAM.

**6055.** (Refer to figures 97 and 100.) What are the time, fuel, and distance from the start of climb to cruise altitude for Operating Condition B-25?

1—11.5 minutes; 170 pounds; 31 NAM.
2—8.0 minutes; 270 pounds; 28 NAM.
3—12.5 minutes; 195 pounds; 38 NAM.

**6056.** (Refer to figures 101 and 103.) At what altitude is the service ceiling with one engine inoperative for Operating Condition B-26?

1—13,000 feet.
2—14,200 feet.
3—13,600 feet.

**6057.** (Refer to figures 101 and 103.) Which statement is true regarding performance with one engine inoperative for Operating Condition B-27?

1—Climb rate at the MEA is more than 50 ft/min.
2—Service ceiling is below the MEA.
3—Bleed air OFF improves service ceiling by 3,000 feet.

**6058.** (Refer to figures 101 and 103.) At what altitude is the service ceiling with one engine inoperative for Operating Condition B-28?

1—1,500 feet above the MEA.
2—10,400 feet.
3—11,800 feet.

**6059.** (Refer to figures 101 and 103.) Which statement is true regarding performance with one engine inoperative for Operating Condition B-29?

1—Service ceiling is more than 100 feet above the MEA.
2—Bleed air must be off to obtain a rate of climb of 50 ft/min at the MEA.
3—Climb is not possible at the MEA.

**6060.** (Refer to figures 101 and 103.) At what altitude is the service ceiling with one engine inoperative for Operating Condition B-30?

1—9,600 feet.
2—13,200 feet.
3—2,100 feet above the MEA.

**6061.** (Refer to figures 102, 104, 105, 106, and 118.) What is the en route time of the cruise leg for Operating Condition B-31?

1—1 hour 11 minutes.
2—1 hour 17 minutes.
3—1 hour 19 minutes.

**6062.** (Refer to figures 102, 104, 105, 106, and 118.) What is the en route time of the cruise leg for Operating Condition B-32?

1—1 hour 13 minutes.
2—1 hour 15 minutes.
3—1 hour 20 minutes.

**6063.** (Refer to figures 102, 104, 105, 106, and 118.) What is the en route time of the cruise leg for Operating Condition B-33?

1—1 hour 50 minutes.
2—1 hour 36 minutes.
3—1 hour 46 minutes.

**6064.** (Refer to figures 102, 104, 105, 106, and 118.) What is the en route time of the cruise leg for Operating Condition B-34?

1—1 hour 6 minutes.
2—1 hour 3 minutes.
3—1 hour 11 minutes.

**6065.** (Refer to figures 102, 104, 105, 106, and 118.) What is the en route time of the cruise leg for Operating Condition B-35?

1—1 hour 6 minutes.
2—1 hour 8 minutes.
3—1 hour 10 minutes.

**6066.** (Refer to figures 102, 104, 105, 106, and 118.) What is the fuel consumption during the cruise leg for Operating Condition B-31?

1—812 pounds.
2—749 pounds.
3—870 pounds.

**6067.** (Refer to figures 102, 104, 105, 106, and 118.) What is the fuel consumption during the cruise leg for Operating Condition B-32?

1—1,028 pounds.
2—896 pounds.
3—977 pounds.

**6068.** (Refer to figures 102, 104, 105, 106, and 118.) What is the fuel consumption during the cruise leg for Operating Condition B-33?

1—1,165 pounds.
2—1,373 pounds.
3—976 pounds.

**6069.** (Refer to figures 102, 104, 105, 106, and 118.) What is the fuel consumption during the cruise leg for Operating Condition B-34?

1—668 pounds.
2—718 pounds.
3—737 pounds.

**6070.** (Refer to figures 102, 104, 105, 106, and 118.) What is the fuel consumption during the cruise leg for Operating Condition B-35?

1—900 pounds.
2—1,030 pounds.
3—954 pounds.

**6071.** (Refer to figure 107.) What are the time and distance to descend from 18,000 feet to 2,500 feet?

1—10.3 minutes, 39 NAM.
2—9.8 minutes, 33 NAM.
3—10.0 minutes, 36 NAM.

**6072.** (Refer to figure 107.) What are the distance and fuel consumption to descend from 22,000 feet to 4,500 feet?

1—44 NAM, 117 pounds.
2—48 NAM, 112 pounds.
3—56 NAM, 125 pounds.

**6073.** (Refer to figure 107.) What are the time and distance to descend from 16,500 feet to 3,500 feet?

1—9.3 minutes, 37 NAM.
2—9.1 minutes, 35 NAM.
3—8.7 minutes, 33 NAM.

**6074.** (Refer to figure 107.) What are the distance and fuel consumption to descend from 13,500 feet to 1,500 feet?

1—30 NAM, 87 pounds.
2—29 NAM, 80 pounds.
3—38 NAM, 100 pounds.

**6075.** (Refer to figure 107.) What are the time and distance to descend from 23,000 feet to 600 feet with an average 15-knot headwind?

1—14.2 minutes, 50 miles.
2—14.6 minutes, 56 miles.
3—14.9 minutes, 59 miles.

**6076.** (Refer to figures 108 and 109.) What is the landing distance over a 50-foot obstacle for Operating Condition B-36?

1—1,900 feet.
2—1,625 feet.
3—950 feet.

**6077.** (Refer to figures 108 and 109.) What are the approach speed and ground roll when landing under Operating Condition B-36?

1—113 knots and 950 feet.
2—113 knots and 1,950 feet.
3—112 knots and 900 feet.

**6078.** (Refer to figures 108 and 109.) What is the remaining runway length when stopped after landing over a 50-foot obstacle for Operating Condition B-37?

1—2,500 feet.
2—2,000 feet.
3—2,600 feet.

**6079.** (Refer to figures 108 and 109.) What are the approach speed and ground roll when landing under Operating Condition B-37.

1—108 knots and 1,400 feet.
2—109 knots and 900 feet.
3—107 knots and 1,350 feet.

**6080.** (Refer to figures 108 and 109.) What is the landing distance over a 50-foot obstacle for Operating Condition B-38?

1—1,850 feet.
2—1,700 feet.
3—1,800 feet.

**6081.** (Refer to figures 108 and 109.) What is the total runway used when touchdown is at the 1,000-foot marker for Operating Condition B-38?

1—2,000 feet.
2—1,700 feet.
3—1,800 feet.

**6082.** (Refer to figures 108 and 109.) What is the remaining runway length when stopped after landing over a 50-foot obstacle for Operating Condition B-39?

1—2,300 feet.
2—2,400 feet.
3—2,500 feet.

**6083.** (Refer to figures 108 and 109.) What are the approach speed and ground roll when landing under Operating Condition B-39?

1—111 knots and 1,550 feet.
2—110 knots and 1,400 feet.
3—109 knots and 1,300 feet.

**6084.** (Refer to figures 108 and 109.) What is the landing distance over a 50-foot obstacle for Operating Condition B-40?

1—1,500 feet.
2—1,750 feet.
3—1,650 feet.

**6085.** (Refer to figures 108 and 109.) What is the total runway used when touching down at the 1,000-foot marker for Operating Condition B-40?

1—1,800 feet.
2—1,650 feet.
3—1,550 feet.

**6086.** (Refer to figure 110.) Given the following conditions, what is the maximum allowable measured gas temperature (MGT) during the power assurance check?

| | |
|---|---|
| Engine torque | 57 percent |
| Pressure altitude | 2,500 ft |
| Temperature (OAT) | +5° C |

1—810° C.
2—815° C.
3—828° C.

**6087.** (Refer to figure 110.) Given the following conditions, what is the maximum allowable measured gas temperature (MGT) during the power assurance check?

| | |
|---|---|
| Engine torque | 49 percent |
| Pressure altitude | 5,500 ft |
| Temperature (OAT) | +25° C |

1—870° C.
2—855° C.
3—880° C.

**6088.** (Refer to figure 110.) Given the following conditions, what is the maximum allowable measured gas temperature (MGT) during the power assurance check?

| | |
|---|---|
| Engine torque | 54 percent |
| Pressure altitude | 500 ft |
| Temperature (OAT) | +25° C |

1—840° C.
2—830° C.
3—820° C.

**6089.** (Refer to figure 110.) Given the following conditions, what is the maximum allowable measured gas temperature (MGT) during the power assurance check?

Engine torque.......................43 percent
Pressure altitude.......................9,000 ft
Temperature (OAT).......................-15° C

1—782° C.
2—768° C.
3—750° C.

**6090.** (Refer to figure 110.) Given the following conditions, what is the maximum allowable measured gas temperature (MGT) during the power assurance check?

Engine torque.......................52 percent
Pressure altitude.......................1,500 ft
Temperature (OAT).......................+35° C

1—880° C.
2—865° C.
3—872° C.

**6091.** (Refer to figure 111.) What is the maximum gross weight for hovering in ground effect at 3,000 feet pressure altitude and +25° C?

1—17,300 pounds.
2—14,700 pounds.
3—16,600 pounds.

**6092.** (Refer to figure 111.) What is the maximum gross weight for hovering in ground effect at 6,000 feet pressure altitude and +15° C?

1—17,200 pounds.
2—16,600 pounds.
3—14,200 pounds.

**6093.** (Refer to figure 111.) What is the maximum gross weight for hovering in ground effect at 7,000 feet pressure altitude and +35° C?

1—13,500 pounds.
2—14,700 pounds.
3—12,100 pounds.

**6094.** (Refer to figure 111.) What is the maximum gross weight for hovering in ground effect at 4,500 feet pressure altitude and +20° C?

1—14,500 pounds.
2—16,500 pounds.
3—17,000 pounds.

**6095.** (Refer to figure 111.) What is the maximum gross weight for hovering in ground effect at 2,500 feet pressure altitude and +35° C?

1—16,200 pounds.
2—16,600 pounds.
3—14,600 pounds.

**6096.** (Refer to figure 112.) What is the maximum gross weight for hovering out of ground effect at 3,000 feet pressure altitude and +30° C?

1—17,500 pounds.
2—14,300 pounds.
3—13,400 pounds.

**6097.** (Refer to figure 112.) What is the maximum gross weight for hovering out of ground effect at 6,000 feet pressure altitude and +15° C?

1—16,800 pounds.
2—13,500 pounds.
3—14,400 pounds.

**6098.** (Refer to figure 112.) What is the maximum gross weight for hovering out of ground effect at 7,000 feet pressure altitude and +35° C?

1—14,000 pounds.
2—11,600 pounds.
3—12,500 pounds.

**6099.** (Refer to figure 112.) What is the maximum gross weight for hovering out of ground effect at 4,500 feet pressure altitude and +20° C?

1—14,500 pounds.
2—14,000 pounds.
3—17,000 pounds.

**6100.** (Refer to figure 112.) What is the maximum gross weight for hovering out of ground effect at 2,500 feet pressure altitude and +30° C?

1—17,400 pounds.
2—15,000 pounds.
3—14,500 pounds.

**6101.** (Refer to figure 113.) Given the following, what is the takeoff distance over a 50-foot obstacle?

Pressure altitude.......................3,500 ft
Temperature (OAT).......................+20° C
Gross weight.......................15,000 lb

1—1,070 feet.
2—1,020 feet.
3—1,100 feet.

**6102.** (Refer to figure 113.) Given the following, what is the takeoff distance over a 50-foot obstacle?

Pressure altitude.......................5,000 ft
Temperature (OAT).......................-10° C
Gross weight.......................11,000 lb

1—1,000 feet.
2—920 feet.
3—870 feet.

**6103.** (Refer to figure 113.) Given the following, what is the takeoff distance over a 50-foot obstacle?

Pressure altitude.......................................................6,500 ft
Temperature (OAT).......................................................0° C
Gross weight.......................................................13,500 lb

1—1,500 feet.
2—1,050 feet.
3—1,100 feet.

**6104.** (Refer to figure 113.) Given the following, what is the takeoff distance over a 50-foot obstacle?

Pressure altitude.......................................................9,000 ft
Temperature (OAT).......................................................+20° C
Gross weight.......................................................15,000 lb

1—1,300 feet.
2—1,350 feet.
3—1,250 feet.

**6105.** (Refer to figure 113.) Given the following, what is the takeoff distance over a 50-foot obstacle?

Pressure altitude.......................................................-1,000 ft
Temperature (OAT).......................................................+25° C
Gross weight.......................................................14,000 lb

1—1,000 feet.
2—900 feet.
3—950 feet.

**6106.** (Refer to figure 114.) Given the following, what is the climb performance with both engines operating?

Pressure altitude.......................................................9,500 ft
Temperature (OAT).......................................................-5° C
Heater.......................................................ON

1—925 ft/min.
2—600 ft/min.
3—335 ft/min.

**6107.** (Refer to figure 114.) Given the following, what is the climb performance with both engines operating?

Pressure altitude.......................................................7,500 ft
Temperature (OAT).......................................................+5° C
Heater.......................................................ON

1—905 ft/min.
2—765 ft/min.
3—1,080 ft/min.

**6108.** (Refer to figure 114.) Given the following, what is the climb performance with both engines operating?

Pressure altitude.......................................................6,500 ft
Temperature (OAT).......................................................+25° C
Heater.......................................................OFF

1—285 ft/min.
2—600 ft/min.
3—400 ft/min.

**6109.** (Refer to figure 114.) Given the following, what is the climb performance with both engines operating?

Pressure altitude.......................................................11,500 ft
Temperature (OAT).......................................................-15° C
Heater.......................................................ON

1—645 ft/min.
2—375 ft/min.
3—330 ft/min.

**6110.** (Refer to figure 114.) Given the following, what is the climb performance with both engines operating?

Pressure altitude.......................................................3,500 ft
Temperature (OAT).......................................................-10° C
Heater.......................................................ON

1—985 ft/min.
2—1,300 ft/min.
3—1,360 ft/min.

**6111.** (Refer to figure 115.) Given the following, what is the single-engine climb or descent performance?

Pressure altitude.......................................................7,500 ft
Temperature (OAT).......................................................0° C

1—80 ft/min descent.
2—10 ft/min climb.
3—50 ft/min climb.

**6112.** (Refer to figure 115.) Given the following, what is the single-engine climb or descent performance?

Pressure altitude.......................................................3,000 ft
Temperature (OAT).......................................................+35° C

1—150 ft/min descent.
2—350 ft/min climb.
3—100 ft/min descent.

**6113.** (Refer to figure 115.) Given the following, what is the single-engine climb or descent performance?

Pressure altitude.......................................................4,700 ft
Temperature (OAT).......................................................+20° C

1—420 ft/min climb.
2—60 ft/min climb.
3—60 ft/min descent.

**6114.** (Refer to figures 115.) Given the following, what is the single-engine climb or descent performance?

Pressure altitude.......................................................9,500 ft
Temperature (OAT).......................................................-10° C

1—600 ft/min descent.
2—840 ft/min descent.
3—280 ft/min descent.

**6115.** (Refer to figure 115.) Given the following, what is the single-engine climb or descent performance?

| | |
|---|---|
| Pressure altitude | 1,500 ft |
| Temperature (OAT) | +45° C |

1—100 ft/min descent.
2—360 ft/min climb.
3—200 ft/min descent.

**6116.** (Refer to figure 116.) Given the following, what is the airspeed limit ($V_{NE}$)?

| | |
|---|---|
| Gross weight | 16,500 lb |
| Pressure altitude | 5,000 ft |
| Temperature (OAT) | -15° C |

1—128 KIAS.
2—133 KIAS.
3—126 KIAS.

**6117.** (Refer to figure 116.) Given the following, what is the airspeed limit ($V_{NE}$)?

| | |
|---|---|
| Gross weight | 17,500 lb |
| Pressure altitude | 4,000 ft |
| Temperature (OAT) | +10° C |

1—114 KIAS.
2—120 KIAS.
3—130 KIAS.

**6118.** (Refer to figure 116.) Given the following, what is the airspeed limit ($V_{NE}$)?

| | |
|---|---|
| Gross weight | 15,000 lb |
| Pressure altitude | 6,000 ft |
| Temperature (OAT) | 0° C |

1—135 KIAS.
2—127 KIAS.
3—143 KIAS.

**6119.** (Refer to figure 116.) Given the following, what is the airspeed limit ($V_{NE}$)?

| | |
|---|---|
| Gross weight | 14,000 lb |
| Pressure altitude | 8,000 ft |
| Temperature (OAT) | -15° C |

1—121 KIAS.
2—123 KIAS.
3—113 KIAS.

**6120.** (Refer to figure 116.) Given the following, what is the airspeed limit ($V_{NE}$)?

| | |
|---|---|
| Gross weight | 12,500 lb |
| Pressure altitude | 14,000 ft |
| Temperature (OAT) | -20° C |

1—99 KIAS.
2—108 KIAS.
3—103 KIAS.

**6121.** (Refer to figure 117.) Given the following, what is the single-engine landing distance over a 50-foot obstacle?

| | |
|---|---|
| Gross weight | 12,000 lb |
| Pressure altitude | 3,500 ft |
| Temperature (OAT) | +30° C |

1—850 feet.
2—900 feet.
3—1,000 feet.

**6122.** (Refer to figure 117.) Given the following, what is the single-engine landing distance over a 50-foot obstacle?

| | |
|---|---|
| Gross weight | 16,500 lb |
| Pressure altitude | 5,500 ft |
| Temperature (OAT) | -10° C |

1—1,700 feet.
2—1,550 feet.
3—1,600 feet.

**6123.** (Refer to figure 117.) Given the following, what is the single-engine landing distance over a 50-foot obstacle?

| | |
|---|---|
| Gross weight | 15,000 lb |
| Pressure altitude | 8,000 ft |
| Temperature (OAT) | +20° C |

1—1,900 feet.
2—1,800 feet.
3—2,000 feet.

**6124.** (Refer to figure 117.) Given the following, what is the single-engine landing distance over a 50-foot obstacle?

| | |
|---|---|
| Gross weight | 14,000 lb |
| Pressure altitude | 1,000 ft |
| Temperature (OAT) | +10° C |

1—650 feet.
2—720 feet.
3—800 feet.

**6125.** (Refer to figure 117.) Given the following, what is the single-engine landing distance over a 50-foot obstacle?

| | |
|---|---|
| Gross weight | 17,000 lb |
| Pressure altitude | 4,000 ft |
| Temperature (OAT) | +40° C |

1—1,850 feet.
2—2,200 feet.
3—2,000 feet.

**6126.** Under which conditions is hydroplaning most likely to occur?

1—When a landing is made at minimum landing speed with an abrupt initial runway contact during heavy precipitation.
2—During conditions of standing water, slush, high speed, and smooth runway texture.
3—During a landing on any wet runway when brake application is delayed until a wedge of water begins to build ahead of the tires.

**6127.** What effect, if any, will landing at a higher-than-recommended touchdown speed have on hydroplaning?

1—No effect on hydroplaning, but increases landing roll.
2—Reduces hydroplaning potential if heavy braking is applied.
3—Increases hydroplaning potential regardless of braking.

**6128.** A takeoff is not recommended if standing water, slush, or wet snow on the runway is more than what maximum depth?

1—1/4 inch.
2—1/2 inch.
3—1 inch.

**6129.** What is the best method of speed reduction if hydroplaning is experienced on landing?

1—Apply full main wheel braking only.
2—Apply nosewheel and main wheel braking alternately and abruptly.
3—Apply aerodynamic braking to the fullest advantage.

**6130.** Compared to dynamic hydroplaning, at what speed does viscous hydroplaning occur when landing on a smooth, wet runway?

1—At approximately 2.0 times the speed that dynamic hydroplaning occurs.
2—At a lower speed than dynamic hydroplaning.
3—At the same speed as dynamic hydroplaning.

**6131.** What term is used to describe hydroplaning which occurs when an airplane's tire is held off a smooth runway by steam generated from the heat of friction?

1—Reverted rubber hydroplaning.
2—Dynamic hydroplaning.
3—Viscous hydroplaning.

**6132.** At what minimum speed will dynamic hydroplaning begin if a tire has an air pressure of 70 PSI?

1—85 knots.
2—80 knots.
3—75 knots.

**6133.** At what minimum speed will dynamic hydroplaning begin if a tire has an air pressure of 90 PSI?

1—85 knots.
2—88 knots.
3—90 knots.

**6134.** At what minimum speed will dynamic hydroplaning begin if a tire has an air pressure of 110 PSI?

1—103 knots.
2—98 knots.
3—94 knots.

**6135.** At what minimum speed will dynamic hydroplaning begin if a tire has an air pressure of 95 PSI?

1—80 knots.
2—88 knots.
3—90 knots.

**6136.** At what minimum speed will dynamic hydroplaning begin if a tire has an air pressure of 80 PSI?

1—80 knots.
2—86 knots.
3—92 knots.

**6137.** Which flight conditions of a large jet airplane create the most severe flight hazard by generating wingtip vortices of the greatest strength?

1—Heavy, slow, gear and flaps up.
2—Heavy, slow, gear and flaps down.
3—Heavy, fast, gear and flaps down.

**6138.** Hazardous vortex turbulence that might be encountered behind large aircraft is created only when that aircraft is

1—developing lift.
2—operating at high airspeeds.
3—using high power settings.

**6139.** Wingtip vortices created by large aircraft tend to

1—sink below the aircraft generating the turbulence.
2—rise from the surface to traffic pattern altitude.
3—accumulate and remain for a period of time at the point where the takeoff roll began.

**6140.** How does the wake turbulence vortex circulate around each wingtip?

1—Inward, upward, and around the wingtip.
2—Counterclockwise when viewed from behind the aircraft.
3—outward, upward, and around the wingtip.

**6141.** Which statement is true concerning the wake turbulence produced by a large transport aircraft?

1—Vortices can be avoided by flying 300 feet below and behind the flightpath of the generating aircraft.
2—The vortex characteristics of any given aircraft may be altered by extending the flaps or changing the speed.
3—Wake turbulence behind a propeller-driven aircraft is negligible because jet engine thrust is a necessary factor in the formation of vortices.

**6142.** What effect would a light crosswind have on the wingtip vortices generated by a large airplane that has just taken off?

1—The upwind vortex will tend to remain on the runway longer than the downwind vortex.
2—A crosswind will rapidly dissipate the strength of both vortices.
3—The downwind vortex will tend to remain on the runway longer than the upwind vortex.

**6143.** To avoid the wingtip vortices of a departing jet airplane during takeoff, the pilot should

1—lift off at a point well past the jet airplane's flightpath.
2—climb above and stay upwind of the jet airplane's flightpath.
3—remain below the flightpath of the jet airplane.

**6144.** What wind condition prolongs the hazards of wake turbulence on a landing runway for the longest period of time?

1—Direct tailwind.
2—Light quartering tailwind.
3—Light quartering headwind.

**6145.** If you take off behind a heavy jet that has just landed, you should plan to lift off

1—prior to the point where the jet touched down.
2—beyond the point where the jet touched down.
3—at the point where the jet touched down and on the upwind edge of the runway.

**6146.** What action is appropriate when encountering the first ripple of reported clear air turbulence?

1—Extend flaps to decrease wing loading.
2—Extend gear to provide more drag and increase stability.
3—Adjust airspeed to that recommended for rough air.

**6147.** If severe turbulence is encountered which procedure is recommended?

1—Maintain a constant altitude.
2—Maintain a constant attitude.
3—Maintain constant airspeed and altitude.

**6148.** What is the expected duration of an individual microburst?

1—Five minutes with maximum winds lasting approximately 2-4 minutes.
2—One microburst may continue for as long as an hour.
3—Seldom longer than 15 minutes from the time the burst strikes the ground until dissipation.

**6149.** Maximum downdrafts in a microburst encounter may be as strong as

1—1,500 feet per minute.
2—4,500 feet per minute.
3—6,000 feet per minute.

**6150** An aircraft that encounters a headwind of 40 knots, within a microburst, may expect a total shear across the microburst of

1—40 knots.
2—80 knots.
3—90 knots.

**6151.** (Refer to figure 119.) If involved in a microburst encounter between which aircraft positions will the most severe downdraft occur?

1—4 and 5.
2—3 and 4.
3—2 and 3.

**6152.** (Refer to figure 119.) When penetrating a microburst, which aircraft will experience an increase in performance without a change in pitch or power?

1—3.
2—2.
3—1.

**6153.** (Refer to figure 119.) The aircraft in position 3 will experience which effect in a microburst encounter?

1—Decreasing headwind.
2—Increasing tailwind.
3—Strong downdraft.

**6154.** (Refer to figure 119.) What effect will a microburst encounter have upon the aircraft in position 4?

1—Strong tailwind.
2—Strong updraft.
3—Significant performance increase.

**6155.** (Refer to figure 119.) How will the aircraft in position 4 be affected by a microburst encounter?

1—Performance increasing with a tailwind and updraft.
2—Performance decreasing with a tailwind and downdraft.
3—Performance decreasing with a headwind and downdraft.

**6156.** Which cockpit indications occur when a constant tailwind component shears to a calm wind?

1—Altitude increases; pitch and indicated airspeed decrease.
2—Altitude, pitch, and indicated airspeed increase.
3—Altitude decreases; pitch and indicated airspeed increase.

**6157.** What effect will a change in wind direction have upon maintaining a 3° glide slope at a constant true airspeed?

1—When groundspeed decreases, rate of descent must increase.
2—When groundspeed increases, rate of descent must increase.
3—Rate of descent must be constant to remain on the glide slope.

**6158.** When passing through an abrupt wind shear which involves a shift from a tailwind to a headwind, what power management would normally be required to maintain a constant indicated airspeed and remain on the ILS glide slope?

1—Lower-than-normal power initially, followed by a further decrease as the wind shear is encountered, then an increase.
2—Higher-than-normal power initially, followed by a decrease as the shear is encountered, then an increase.
3—Lower-than-normal power initially, followed by an increase as the shear is encountered, then a decrease.

**6159.** While flying an ILS glide slope, a constant tailwind shears to a calm wind. Which conditions should the pilot expect?

1—Airspeed and pitch attitude decrease, and a tendency to go below the glide slope.
2—Airspeed and pitch attitude increase, and a tendency to go above the glide slope.
3—Airspeed and pitch attitude decrease, and a tendency to go above the glide slope.

**6160** While flying an ILS glide slope, a headwind shears to a tailwind. Which conditions should the pilot expect?

1—Airspeed and pitch attitude decrease, and a tendency to go below the glide slope.
2—Airspeed and pitch attitude increase, and a tendency to go above the glide slope.
3—Airspeed and pitch attitude decrease, and a tendency to go above the glide slope.

**6161.** During an en route descent in a fixed thrust and fixed-pitch attitude configuration, both the ram air input and drain hole of the pitot system become completely blocked by ice. What airspeed indication can be expected?

1—Increase in indicated airspeed.
2—Decrease in indicated airspeed.
3—Indicated airspeed remains at the value prior to icing.

**6162.** What can a pilot expect if the pitot system ram air input and drain hole are blocked by ice?

1—The airspeed indicator may act as an altimeter.
2—The airspeed indicator will show a decrease with an increase in altitude.
3—No airspeed indicator change will occur during climbs or descents.

**6163.** If both the ram air input and drain hole of the pitot system are blocked by ice, what airspeed indication can be expected?

1—No variation of indicated airspeed in level flight if large power changes are made.
2—Decrease of indicated airspeed during a climb.
3—Constant indicated airspeed during a descent.

**6164.** What effect does an uphill runway slope have upon takeoff performance?

1—Increases takeoff distance.
2—Decreases takeoff speed.
3—Decreases takeoff distance.

**6165.** Under which condition during the landing roll are the main wheel brakes at maximum effectiveness?

1—When wing lift has been reduced.
2—At high groundspeeds.
3—When the wheels are locked and skidding.

**6166.** Which condition has the effect of reducing critical engine failure speed?

1—Slush on the runway or inoperative antiskid.
2—Low gross weight.
3—High density altitude.

**6167.** How should thrust reversers be applied to reduce landing distance for turbojet aircraft?

1—Immediately after ground contact.
2—Immediately prior to touchdown.
3—After applying maximum wheel braking.

**6168.** Throughout the landing roll, what is the most effective method of deceleration regardless of runway surface?

1—Application of aerodynamic drag devices.
2—Continuous use of thrust reversers.
3—Judicious use of wheel brakes.

**6169.** During the takeoff roll, which factor decreases as airspeed increases?

1—Aerodynamic drag.
2—Rolling friction.
3—Coefficient of lift.

**6170.** Which condition reduces the required runway for takeoff?

1—Higher-than-recommended airspeed before rotation.
2—Lower-than-standard air density.
3—Increased headwind component.

**6171.** Which performance factor decreases as airplane gross weight increases?

1—Critical engine failure speed.
2—Rotation speed.
3—Accelerate-stop distance.

**6172.** Maximum range performance of a turbojet aircraft is obtained by which procedure as aircraft weight reduces?

1—Increasing speed or altitude.
2—Increasing altitude or decreasing speed.
3—Increasing speed or decreasing altitude.

**6173.** Which procedure produces the minimum fuel consumption for a given leg of the cruise flight?

1—Increase speed for a headwind.
2—Increase speed for a tailwind.
3—Increase altitude for a headwind, decrease altitude for a tailwind.

**6174.** How should reverse thrust propellers be used during landing for maximum effectiveness in stopping?

1—Gradually increase reverse power to maximum as rollout speed decreases.
2—Use maximum reverse power as soon as possible after touchdown.
3—Select reverse-pitch after landing and use idle power setting of the engines.

**6175.** To obtain optimum range conditions in a turbojet airplane, cruising flight should be planned

1—at any altitude within the troposphere.
2—at, or above the tropopause.
3—at any altitude above the jetstream level.

**6176.** Which place in the turbojet engine is subjected to the highest temperature?

1—Compressor discharge.
2—Fuel spray nozzles.
3—Turbine inlet.

**6177.** What effect would a change in ambient temperature or air density have on gas-turbine-engine performance?

1—As air density decreases, thrust increases.
2—As temperature increases, thrust increases.
3—As temperature increases, thrust decreases.

**6178.** The most important restriction to the operation of turbojet or turboprop engines is

1—limiting compressor speed.
2—limiting exhaust gas temperature.
3—limiting torque.

**6179.** As outside air pressure decreases, thrust output will

1—increase due to greater efficiency of jet aircraft in thin air.
2—remain the same since compression of inlet air will compensate for any decrease in air pressure.
3—decrease due to higher density altitude.

**6180.** What effect will an increase in altitude have upon the available equivalent shaft horsepower (ESHP) of a turboprop engine?

1—Lower air density and engine mass flow will cause a decrease in power.
2—Higher propeller efficiency will cause an increase in usable power (ESHP) and thrust.
3—Power will remain the same but propeller efficiency will decrease.

**6181.** What effect, if any, does high ambient temperature have upon the thrust output of a turbine engine?

1—Thrust will be reduced due to the decrease in air density.
2—Thrust will remain the same, but turbine temperature will be higher.
3—Thrust will be higher because more heat energy is extracted from the hotter air.

**6182.** What characterizes a transient compressor stall?

1—Loud, steady roar accompanied by heavy shuddering.
2—Sudden loss of thrust accompanied by a loud whine.
3—Intermittent "bang," as backfires and flow reversals take place.

**6183.** What indicates that a compressor stall has developed and become steady?

1—Strong vibrations and loud roar.
2—Occasional loud "bang" and flow reversal.
3—Complete loss of power with severe reduction in airspeed.

**6184.** Which type of compressor stall has the greatest potential for severe engine damage?

1—Intermittent "backfire" stall.
2—Transient "backfire" stall.
3—Steady, continuous flow reversal stall.

**6185.** What recovery would be appropriate in the event of compressor stall?

1—Reduce fuel flow, reduce angle of attack, and increase airspeed.
2—Advance throttle, lower angle of attack, and reduce airspeed.
3—Reduce throttle, reduce airspeed, and increase angle of attack.

**6186.** Under normal operating conditions, which combination of MAP and RPM produce the most severe wear, fatigue, and damage to high performance reciprocating engines?

1—High RPM and low MAP.
2—Low RPM and high MAP.
3—High RPM and high MAP.

**6187.** What effect does high relative humidity have upon the maximum power output of modern aircraft engines?

1—Neither turbojet or reciprocating engines are affected.
2—Reciprocating engines will experience a significant loss of BHP.
3—Turbojet engines will experience a significant loss of thrust.

**6188.** Equivalent shaft horsepower (ESHP) of a turboprop engine is a measure of

1—turbine inlet temperature.
2—shaft horsepower and jet thrust.
3—propeller thrust only.

**6189.** Minimum specific fuel consumption of the turboprop engine is normally available in which altitude range?

1—10,000 feet to 25,000 feet.
2—25,000 feet to the tropopause.
3—The tropopause to 45,000 feet.

**6190.** Where is the critical altitude of a supercharged-reciprocating engine?

1—The highest altitude at which a desired manifold pressure can be obtained.
2—Highest altitude where the mixture can be leaned to best power ratio.
3—The altitude at which maximum allowable BMEP can be obtained.

**6191.** What is controlled by the waste gate of a turbocharged-reciprocating engine?

1—Supercharger gear ratio.
2—Exhaust gas discharge.
3—Throttle opening.

**6192.** How is manual lean (best economy) cruising mixture setting obtained on a large, supercharged, reciprocating engine?

1—Lean to best power BMEP, then enrichen a specific RPM drop.
2—Lean to the detonation point, then enrichen a specific BMEP rise.
3—Lean to best power BMEP, then lean to a specific BMEP drop.

**6193.** What occurs when operating above 35,000 feet in the event of a complete cabin pressure loss?

1—The oxygen pressure within the lungs cannot be maintained without a positive increase of inhaled oxygen pressure.
2—Vision improves significantly as cabin altitude increases because carbon dioxide is released from the body.
3—Gases trapped in the body contract and prevent nitrogen from escaping the bloodstream.

**6194.** What is a symptom of carbon monoxide poisoning?

1—Rapid, shallow breathing.
2—Pain and cramping of the hands and feet.
3—Dizziness.

**6195.** Which would most likely result in hyperventilation?

1—A stressful situation causing anxiety.
2—The excessive consumption of alcohol.
3—An extremely slow rate of breathing and insufficient oxygen.

**6196.** What causes hypoxia?

1—Excessive carbon dioxide in the atmosphere.
2—An increase in nitrogen content of the air at high altitudes.
3—A decrease of oxygen partial pressure.

**6197.** Which is a common symptom of hyperventilation?

1—Tingling of the hands, legs, and feet.
2—Increased vision keenness.
3—Decreased breathing rate.

**6198.** Loss of cabin pressure may result in hypoxia because as cabin altitude increases

1—the percentage of nitrogen in the air is increased.
2—the percentage of oxygen in the air is decreased
3—oxygen partial pressure is decreased.

**6199.** Hypoxia is the result of which of these conditions?

1—Insufficient oxygen reaching the brain.
2—Excessive carbon dioxide in the bloodstream.
3—Limited oxygen reaching the heart muscles.

**6200.** Rapid or extra deep breathing can cause a condition known as

1—hypoxia.
2—vertigo
3—hyperventilation.

**6201.** What is the effect of alcohol consumption on functions of the body?

1—Alcohol has an adverse effect, especially as altitude increases.
2—Small amounts of alcohol in the human system increase judgment and decision-making abilities.
3—Alcohol has little effect if followed by equal quantities of black coffee.

**6202.** A pilot is more subject to spatial disorientation when

1—ignoring or overcoming the sensations of muscles and inner ear.
2—eyes are moved often in the process of cross-checking the flight instruments.
3—body sensations are used to interpret flight attitudes.

**6203.** Which procedure is recommended to prevent or overcome spatial disorientation?

1—Reduce head and eye movement to the greatest possible extent.
2—Rely on the kinesthetic sense.
3—Rely entirely on the indications of the flight instruments.

**6204.** What is the most effective way to use the eyes during night flight?

1—Look only at far away, dim lights.
2—Scan slowly to permit off center viewing.
3—Concentrate directly on each object for a few seconds.

**6205.** Microbursts are small-scale intense downdrafts which

1—are easily detected visually due to their association with heavy rain showers.
2—dissipate prior to reaching the surface when the wind gradient is positive.
3—upon reaching the surface, spread outward in all directions.

**6206.** The illusion of being in a noseup attitude which may occur during a rapid acceleration takeoff is known as

1—inversion illusion.
2—autokinesis.
3—somatogravic illusion.

**6207.** In the dark, a stationary light will appear to move when stared at for a period of time. This illusion is known as

1—somatogravic illusion.
2—ground lighting illusion.
3—autokinesis.

**6208.** When making a landing over darkened or featureless terrain such as water or snow, a pilot should be aware of the possibility of illusion. The approach may appear to be too

1—high.
2—low.
3—shallow.

**6209.** When making an approach to a narrower-than-usual runway, without VASI assistance, the pilot should be aware that the approach

1—altitude may be higher than it appears.
2—altitude may be lower than it appears.
3—may result in leveling off too high and landing hard.

**6210.** While making prolonged constant rate turns under IFR conditions, an abrupt head movement can create the illusion of rotation on an entirely different axis. This is known as

1—autokinesis.
2—Coriolis illusion.
3—the leans.

**6211.** Which observed target aircraft would be of most concern with respect to collision avoidance?

1—One which appears to be ahead and moving from left to right at high speed.
2—One which appears to be ahead and moving from right to left at slow speed.
3—One which appears to be ahead with no lateral or vertical movement and is increasing in size.

**6212.** Scanning procedures for effective collision avoidance should constitute

1—looking outside for 15 seconds, then inside for 5 seconds, then repeat.
2—1 minute inside scanning, then 1 minute outside scanning , then repeat.
3—looking outside every 30 seconds except in radar contact when outside scanning is unnecessary.

**6213.** When using the Earth's horizon as a reference point to determine the relative position of other aircraft, most concern would be for aircraft

1—above the horizon and increasing in size.
2—on the horizon with little relative movement.
3—on the horizon and increasing in size.

**6214.** Where should a non-ambulatory handicapped passenger be seated to expeditiously accomplish emergency evacuation?

1—At the beginning of a line of passengers that would be evacuated through an overwing exit.
2—Near the beginning of a line of passengers that would be evacuated through a main exit.
3—Near the end of a line of passengers that would be evacuated through a floor-level, non-overwing exit.

**6215.** An ambulatory handicapped passenger should be seated in an area where emergency evacuation can be accomplished through

1—the aft normal or emergency exit.
2—an overwing exit.
3—a floor-level exit.

**6216.** Which activity is not considered to be a form of "holding out"?

1—Word-of-mouth information that charter flight services are continuously available.
2—Full-time employment as pilot of a company-owned aircraft.
3—Posting a schedule of available charter flight services in a fixed-base operator's pilot lounge.

**6217.** Which term describes a type of private carrier?

1—Contract carrier.
2—Restricted commercial carrier.
3—Common carrier.

**6218.** Which statement best describes the term "holding out"?

1—Offers to the public: the carriage of persons or property for hire, either intrastate or interstate.
2—Carriage of persons or property for hire for a few selected customers on an intrastate basis.
3—Carriage of cargo for an industrial firm on an intrastate basis.

**6219.** Which is the key factor that determines that an operator is a common carrier rather than a private carrier?

1—Engaging in intrastate carriage of persons or property.
2—Expression of willingness to carry all customers.
3—Engaging in a limited operation of the intrastate carriage of manufactured components for one company.

**6220.** An operator who occasionally refuses to transport persons or property, and who holds out on an informal basis,

1—may be considered to meet the criteria for common carriage.
2—may be considered a common carrier only if the transportation of persons or property is interstate.
3—is a private carrier unless operating under a contract, charter, or mail agreement.

**6221.** An aircraft configured for air ambulance operations should include

1—four-point floor anchor points and approved web-type restraints for securing stretchers.
2—a seat near the patient for an attendant.
3—a nitrous oxide supply and breathing mask for in-flight patient sedation.

**6222.** Which is a factor that tends to establish an operator as a private carrier?

1—Charter flying for only one organization although flights are open to the public.
2—Carriage of selected customers on a long-term basis where no holding out is involved.
3—Making known publicly, through reputation (not advertising), that all customers will be provided transportation service.

**6223.** A carrier which offers transportation pursuant to separately negotiated contracts, and is holding out by reputation only,

1—is engaged in private carriage whether operations are intrastate or interstate.
2—may be classified as a common carrier.
3—meets the criteria of private carriage if the contracts stipulate interstate operations.

**6224.** An intrastate commercial operator meets the criteria that has been established for a common carrier if it

1—carries only employees of one corporation for hire within the boundaries of one state, on a long-term basis.
2—does not hold out transportation service to the public and operates with very few contracts.
3—offers to carry manufactured components under 15 individual contracts on interstate flights.

**6225.** On a number of occasions an operator makes verbal offers to senior citizens' groups to transport them in his aircraft to a casino located in another state. This operator would be considered to be

1—a common carrier if compensation is received from the passengers.
2—a private carrier because there is no published holding out of services.
3—engaged in common carriage if the trip generates a profit and private carriage if no profit is realized.

**6226.** What is a characteristic of the troposphere?

1—It contains all the moisture of the atmosphere.
2—There is an overall decrease of temperature with an increase of altitude.
3—The average altitude of the top of the troposphere is about 6 miles.

**6227.** The primary cause of all changes in the Earth's weather is

1—variations of solar energy at the Earth's surface.
2—changes in air pressure over the Earth's surface.
3—movement of airmasses from moist areas to dry areas.

**6228.** A ground based inversion is characterized by

1—convection currents at the surface.
2—cold temperatures.
3—poor visibility.

**6229.** What feature is associated with a temperature inversion?

1—A stable layer of air.
2—An unstable layer of air.
3—Airmass thunderstorms.

**6230.** When does minimum temperature normally occur during a 24-hour period?

1—After sunrise.
2—About 1 hour before sunrise.
3—At midnight.

**6231.** Where is a common location for an inversion?

1—At the tropopause.
2—In the stratosphere.
3—At the base of cumulus clouds.

**6232.** The most frequent type of ground- or surface-based temperature inversion is produced by

1—the movement of colder air under warm air, or the movement of warm air over cold air.
2—widespread sinking of air within a thick layer aloft resulting in heating by compression.
3—terrestrial radiation on a clear, relatively calm night.

**6233.** Which term applies when the temperature of the air changes by compression or expansion with no heat added or removed?

1—Katabatic.
2—Advection.
3—Adiabatic.

**6234.** Unsaturated air flowing upslope will cool at the rate of about

1—3° C per 1,000 feet.
2—2° C per 1,000 feet.
3—4° C per 1,000 feet.

**6235.** If the ambient temperature is warmer than standard at FL350, what is the density altitude compared to pressure altitude?

1—Lower than pressure altitude.
2—Higher than pressure altitude.
3—Impossible to determine without information on possible inversion layers at lower altitudes.

**6236.** If the ambient temperature is colder than standard at FL310, what is the relationship between true altitude and pressure altitude?

1—They are both the same, 31,000 feet.
2—True altitude is lower than 31,000 feet.
3—Pressure altitude is lower than true altitude.

**6237.** Which pressure is defined as station pressure?

1—Altimeter setting.
2—Actual pressure at field elevation.
3—Station barometric pressure reduced to sea level.

**6238.** Isobars on a surface weather chart represent lines of equal pressure

1—at the surface.
2—reduced to sea level.
3—at a given atmospheric pressure altitude.

**6239.** En route at FL250, the altimeter is set correctly. On descent, a pilot fails to set the local altimeter setting of 30.32. If the field elevation is 800 feet, and the altimeter is functioning properly, what will it indicate upon landing?

1—1,200 feet.
2—400 feet.
3—Sea level.

**6240.** En route at FL270, the altimeter is set correctly. On descent, a pilot fails to set the local altimeter setting of 30.57. If the field elevation is 650 feet, and the altimeter is functioning properly, what will it indicate upon landing?

1—585 feet.
2—1,300 feet.
3—Sea level.

**6241.** What is corrected altitude (approximate true altitude)?

1—Pressure altitude corrected for instrument error.
2—Indicated altitude corrected for temperature variation from standard.
3—Density altitude corrected for temperature variation from standard.

**6242.** An elongated area of low pressure is called a

1—trough.
2—ridge.
3—hurricane or typhoon.

**6243.** What is an important characteristic of wind shear?

1—It is primarily associated with the lateral vortices generated by thunderstorms.
2—It usually exists only in the vicinity of thunderstorms, but may be found near a strong temperature inversion.
3—It may be associated with either a wind shift or a windspeed gradient at any level in the atmosphere.

**6244.** "SOUTH BOUNDARY WIND ONE SIX ZERO AT TWO FIVE, WEST BOUNDARY WIND TWO FOUR ZERO AT THREE FIVE."

This information from the control tower indicates that

1—a downburst is located at the center of the airport.
2—wake turbulence exists on the west side of the active runway.
3—there is a possibility of wind shear over or near the airport.

**6245.** At which location does Coriolis force have the least effect on wind direction?

1—At the poles.
2—Middle latitudes (30° to 60°).
3—At the Equator.

**6246.** How does Coriolis force affect wind direction in the Southern Hemisphere?

1—Causes clockwise rotation around a low.
2—Causes wind to flow out of a low toward a high.
3—Has exactly the same effect as in the Northern Hemisphere.

**6247.** Which weather condition is defined as an anticyclone?

1—Calm.
2—High pressure area.
3—COL.

**6248.** Which area or areas of the Northern Hemisphere experience a generally east to west movement of weather systems?

1—Arctic only.
2—Arctic and subtropical.
3—Subtropical only.

**6249.** At lower levels of the atmosphere, friction causes the wind to flow across isobars into a low because the friction

1—decreases windspeed and Coriolis force.
2—decreases pressure gradient force.
3—creates air turbulence and raises atmospheric pressure.

**6250.** Which type wind flows down-slope becoming warmer and dryer?

1—Land breeze.
2—Valley wind.
3—Katabatic wind.

**6251.** What is a feature of air movement in a high pressure area?

1—Ascending from the surface high to lower pressure at higher altitudes.
2—Descending to the surface and then outward.
3—Moving outward from the high at high altitudes and into the high at the surface.

**6252.** What is the normal direction of a valley wind?

1—Up the mountain slope in the day time.
2—Down the mountain slope in the day time.
3—Up the mountain slope on the west side due to prevailing westerly winds.

**6253.** Where is the usual location of a thermal low?

1—Over the arctic region.
2—Over the eye of a hurricane.
3—Over the surface of a dry, sunny region.

**6254.** Freezing rain encountered during climb is normally evidence that

1—a climb can be made to a higher altitude without encountering more than light icing.
2—there exists a layer of warmer air above.
3—ice pellets at higher altitudes have changed to rain in the warmer air below.

**6255.** What temperature condition is indicated if precipitation in the form of wet snow occurs during flight?

1—The temperature is above freezing at flight altitude.
2—The temperature is above freezing at higher altitudes.
3—There is an inversion with colder air below.

**6256.** Which conditions result in the formation of frost?

1—The temperature of the collecting surface is at or below freezing and small droplets of moisture are falling.
2—Dew collects on the surface and then freezes because the surface temperature is lower than the air temperature.
3—Temperature of the collecting surface is below the dewpoint and the dewpoint is also below freezing.

**6257.** Ice pellets encountered during flight always indicate that there

1—are thunderstorms at higher levels.
2—is freezing rain at higher levels.
3—is snow at higher levels.

**6258.** When will frost most likely form on aircraft surfaces?

1—On clear nights with stable air and light winds.
2—On overcast nights with freezing drizzle precipitation.
3—On clear nights with convective action and a small temperature/dewpoint spread.

**6259.** What is the result when water vapor changes to the liquid state while being lifted in a thunderstorm?

1—Latent heat is released to the atmosphere.
2—Latent heat is transformed into pure energy.
3—Latent heat is absorbed from the surrounding air by the water droplet.

**6260.** What is a feature of supercooled water?

1—The water drop sublimates to an ice particle upon impact.
2—The unstable water drop freezes upon striking an exposed object.
3—The temperature of the water drop remains at 0° C until it impacts a part of the airframe, then clear ice accumulates.

**6261.** What minimum thickness of cloud layer is indicated if precipitation is reported as light or greater intensity?

1—4,000 feet thick.
2—2,000 feet thick.
3—A thickness which allows the cloud tops to be higher than the freezing level.

**6262.** Which condition produces weather on the lee side of a large lake?

1—Warm air flowing over a colder lake may produce fog.
2—Cold air flowing over a warmer lake may produce advection fog.
3—Warm air flowing over a cool lake may produce rain showers.

**6263.** Stability of the atmosphere can be determined by measurement of the

1—ambient temperature lapse rate.
2—atmospheric pressure at various levels.
3—surface temperature/dewpoint spread.

**6264.** What is indicated about an airmass if the temperature remains unchanged or decreases slightly as altitude is increased?

1—The air is unstable.
2—A temperature inversion exists.
3—The air is stable.

**6265.** What weather condition occurs at the altitude where the dewpoint lapse rate and the dry adiabatic lapse rate converge?

1—Cloud bases form.
2—Precipitation starts.
3—Stable air changes to unstable air.

**6266.** Which process causes adiabatic cooling?

1—Expansion of air as it rises.
2—Movement of air over a colder surface.
3—Release of latent heat during the vaporization process.

**6267.** When saturated air moves downhill its temperature increases

1—at a faster rate than dry air because of the release of latent heat.
2—at a slower rate than dry air because vaporization uses heat.
3—at a slower rate than dry air because condensation releases heat.

**6268.** Which condition is present when a local parcel of air is stable?

1—The parcel of air resists convection.
2—The parcel of air cannot be forced uphill.
3—As the parcel of air moves upward, its temperature becomes warmer than the surrounding air.

**6269.** Convective clouds which penetrate a stratus layer can produce which threat to instrument flight?

1—Freezing rain.
2—Clear air turbulence.
3—Embedded thunderstorms.

**6270.** Which type clouds are indicative of very strong turbulence?

1—Nimbostratus.
2—Standing lenticular.
3—Cirrocumulus.

**6271.** What is a feature of a stationary front?

1—The warm front surface moves about half the speed of the cold front surface.
2—Weather conditions are a combination of strong cold front and strong warm front weather.
3—Surface winds tend to flow parallel to the frontal zone.

**6272.** Which event usually occurs after an aircraft passes through a front into the colder air?

1—Temperature/dewpoint spread decreases.
2—Wind direction shifts to the left.
3—Atmospheric pressure increases.

**6273.** What type weather change is to be expected in an area where frontolysis is reported?

1—The frontal weather is becoming stronger.
2—The front is dissipating.
3—The front is moving at a faster speed.

**6274.** Which weather condition is an example of a nonfrontal instability band?

1—Squall line.
2—Advective fog.
3—Frontogenesis.

**6275.** Which atmospheric factor causes rapid movement of surface fronts?

1—Upper winds blowing across the front.
2—Upper low located directly over the surface low.
3—The cold front overtaking and lifting the warm front.

**6276.** Frontal waves and low pressure areas may form on

1—warm fronts or occluded fronts.
2—slow moving cold fronts or stationary fronts.
3—cold front occlusions.

**6277.** What weather difference is found on each side of a "dry line"?

1—Extreme temperature difference.
2—Dewpoint difference.
3—Stratus versus cumulus clouds.

**6278.** Under what conditions would clear air turbulence (CAT) most likely be encountered?

1—When constant pressure charts show 20-knot isotachs less than 60 NM apart.
2—When constant pressure charts show 60-knot isotachs less than 20 NM apart.
3—When a sharp trough is moving at a speed less than 20 knots.

**6279.** Which is a necessary condition for the occurrence of a low-level temperature inversion wind shear?

1—The temperature differential between the cold and warm layers must be at least 10° C.
2—A calm or light wind near the surface and a relatively strong wind just above the inversion.
3—A wind direction difference of at least 30° between the wind near the surface and the wind just above the inversion.

**6280.** What is the lowest cloud in the stationary group associated with a mountain wave?

1—Rotor cloud.
2—Standing lenticular.
3—Low stratus.

**6281.** What action is recommended when encountering turbulence due to a wind shift associated with a sharp pressure trough?

1—Establish a course across the trough.
2—Climb or descend to a smoother level.
3—Increase speed to get out of the trough as soon as possible.

**6282.** In comparison to an approach in a moderate headwind, which is an indication of a possible wind shear due to a decreasing headwind when descending on the glide slope?

1—Less power is required.
2—Higher pitch attitude is required.
3—Lower descent rate is required.

**6283.** Which factor changes to cause a loss of lift when the airplane encounters a downburst during an otherwise stable ILS approach?

1—Pitch attitude decreases.
2—Downward loading of the tail surfaces increases.
3—Angle of attack decreases.

**6284.** Which maximum speed increase is recommended when making an approach where wind shear is suspected?

1—$V_{REF}$ plus 20.
2—$V_{REF}$ plus 30.
3—$V_2$ plus 30.

**6285.** What condition is necessary for the formation of structural icing in flight?

1—Supercooled water drops.
2—Water vapor.
3—Visible water.

**6286.** How will the airspeed indicator react if the ram air input to the pitot head is blocked by ice, but the drain hole and static port are not?

1—Indication will drop to zero.
2—Indication will rise to the top of the scale.
3—Indication will remain constant but will increase in a climb.

**6287.** Which type precipitation is an indication that supercooled water is present?

1—Wet snow.
2—Freezing rain.
3—Ice pellets.

**6288.** Which type of icing is associated with the smallest size of water droplet similar to that found in low level stratus clouds?

1—Clear ice.
2—Frost ice.
3—Rime ice.

**6289.** Which weather phenomenon signals the beginning of the mature stage of a thunderstorm?

1—The appearance of an anvil top.
2—The start of rain at the surface.
3—Growth rate of the cloud is at its maximum.

**6290.** During the life cycle of a thunderstorm, which stage is characterized predominately by downdrafts?

1—Cumulus.
2—Dissipating.
3—Mature.

**6291.** What feature is normally associated with the cumulus stage of a thunderstorm?

1—Beginning of rain at the surface.
2—Frequent lightning.
3—Continuous updraft.

**6292.** What is indicated by the term embedded thunderstorms?

1—Severe thunderstorms are embedded in a squall line.
2—Thunderstorms are predicted to develop in a stable airmass.
3—Thunderstorms are obscured by other types of clouds.

**6293.** Where do squall lines most often develop?

1—In an occluded front.
2—Ahead of a cold front.
3—Behind a stationary front.

**6294.** Where can the maximum hazard zone caused by wind shear associated with a thunderstorm be found?

1—In front of the thunderstorm cell (anvil side) and on the southwest side of the cell.
2—Ahead of the roll cloud or gust front and directly under the anvil cloud.
3—On all sides and directly under the thunderstorm cell.

**6295.** Which type cloud is associated with violent turbulence and a tendency toward the production of funnel clouds?

1—Cumulonimbus mamma.
2—Standing lenticular.
3—Stratocumulus.

**6296.** A clear area in a line of thunderstorm echos on a radar scope indicates

1—the absence of clouds in the area.
2—an area of no convective turbulence.
3—an area where precipitation drops are not detected.

**6297.** When flying over the top of a severe thunderstorm, the cloud should be overflown by at least

1—1,000 feet for each 10 knots windspeed.
2—2,500 feet.
3—500 feet above any moderate to severe turbulence layer.

**6298.** Atmospheric pressure changes due to a thunderstorm will be at the lowest value

1—during the downdraft and heavy rain showers.
2—when the thunderstorm is approaching.
3—immediately after the rain showers have stopped.

**6299.** Downdrafts in a mature thunderstorm are hazardous because they

1—are kept cool by cold rain which tends to accelerate the downward velocity.
2—converge toward a central location under the storm after striking the surface.
3—become warmer than the surrounding air and reverse into an updraft before reaching the surface.

**6300.** What is a difference between an airmass thunderstorm and a steady-state thunderstorm?

1—Airmass thunderstorms produce precipitation which falls outside of the updraft.
2—Airmass thunderstorm downdrafts and precipitation retard and reverse the updrafts.
3—Steady-state thunderstorms are associated with local surface heating.

**6301.** Which type storms are most likely to produce funnel clouds or tornadoes?

1—Airmass thunderstorms.
2—Cold front or squall line thunderstorms.
3—Storms associated with icing and supercooled water.

**6302.** When advection fog has developed, what may tend to dissipate or lift the fog into low stratus clouds?

1—Temperature inversion.
2—Wind stronger than 15 knots.
3—Surface radiation.

**6303.** Which conditions are necessary for the formation of upslope fog?

1—Moist, stable air being moved over gradually rising ground by a wind.
2—A clear sky, little or no wind, and 100 percent relative humidity.
3—Rain falling through stratus clouds and a 10- to 25-knot wind moving the precipitation up the slope.

**6304.** Haze layers are cleared or dispersed by

1—convective mixing in cool night air.
2—a wind or the movement of air.
3—evaporation similar to the clearing of fog.

**6305.** Which feature is associated with the tropopause?

1—Absence of wind and turbulence.
2—Absolute upper limit of cloud formation.
3—Abrupt change of temperature lapse rate.

**6306.** Turbulence encountered above 15,000 feet AGL, not associated with cloud formations, should be reported as

1—convective turbulence.
2—high altitude turbulence.
3—clear air turbulence.

**6307.** A strong wind shear can be expected

1—on the low-pressure side of a 100-knot jetstream core.
2—where the 20-knot isotachs are spaced 100 NM or closer together.
3—if the 5° C isotherms are spaced 100 NM or closer together.

**6308.** A most likely location of clear air turbulence is

1—in an upper trough on the polar side of a jetstream.
2—near a ridge aloft on the equatorial side of a high pressure flow.
3—downstream of the equatorial side of a jetstream.

**6309.** The strength and location of a jetstream is normally

1—stronger and farther north in the winter.
2—weaker and farther north in the summer.
3—weaker and farther south in the winter.

**6310.** Where do the maximum winds associated with the jetstream usually occur?

1—In the vicinity of breaks in the tropopause on the polar side of the jet core.
2—Below the jet core where a long straight stretch of the jetstream is located.
3—On the equatorial side of the jetstream where moisture has formed cirriform clouds.

**6311.** Which type jetstream can be expected to cause the greater turbulence?

1—A straight jetstream associated with a high pressure ridge.
2—A jetstream associated with a wide isotherm spacing.
3—A curving jetstream associated with a deep low pressure trough.

**6312.** What weather feature occurs at altitude levels near the tropopause?

1—Maximum winds and narrow wind shear zones.
2—Abrupt temperature increase above the tropopause.
3—Thin layers of cirrus (ice crystal) clouds at the tropopause level.

**6313.** Where are jetstreams normally located?

1—In areas of strong low pressure systems in the stratosphere.
2—At the tropopause where intensified temperature gradients are located.
3—In a single continuous band, encircling the Earth, where there is a break between the equatorial and polar tropopause.

**6314.** Where is the normal location of the jetstream relative to surface lows and fronts?

1—The jetstream is located north of the surface systems.
2—The jetstream is located south of the low and warm front.
3—The jetstream is located over the low and crosses both the warm front and the cold front.

**6315.** Which type frontal system is normally crossed by the jetstream?

1—Cold front and warm front.
2—Warm front.
3—Occluded front.

**6316.** Which type clouds may be associated with the jetstream?

1—Cumulonimbus cloud line where the jetstream crosses the cold front.
2—Cirrus clouds on the equatorial side of the jetstream.
3—Cirrostratus cloud band on the polar side and under the jetstream.

**6317.** Which action is recommended if jetstream turbulence is encountered with a direct headwind or tailwind?

1—Increase airspeed to get out of the area quickly.
2—Change course to fly on the polar side of the jetstream.
3—Change altitude or course to avoid a possible elongated turbulent area.

**6318.** Which action is recommended regarding an altitude change to get out of jetstream turbulence?

1—Descend if ambient temperature is falling.
2—Descend if ambient temperature is rising.
3—Maintain altitude if ambient temperature is not changing.

**6319.** Clear air turbulence associated with a mountain wave may extend as far as

1—1,000 miles or more downstream of the mountain.
2—5,000 feet above the tropopause.
3—100 miles or more upwind of the mountain.

**6320.** Summer thunderstorms in the Arctic region will generally move

1—northeast to southwest in polar easterlies.
2—southwest to northeast with the jetstream flow.
3—directly north to south with the low level polar airflow.

**6321.** Which arctic flying hazard is caused when a cloud layer of uniform thickness overlies a snow or ice covered surface?

1—Ice fog.
2—Whiteout.
3—Blowing snow.

**6322.** Which weather condition is associated with the "Intertropical Convergence Zone" near the Equator?

1—Permanent low-pressure area at the surface.
2—Air rising, frequent thunderstorms, and heavy rains.
3—Development of tropical cyclones which may grow into hurricanes or typhoons.

**6323.** Which weather condition is present when the tropical storm is upgraded to a hurricane?

1—Highest windspeed, 100 knots or more.
2—A clear area or hurricane eye has formed.
3—Sustained winds of 65 knots or more.

**6324.** What is the general direction of movement of a hurricane located in the Caribbean or Gulf of Mexico region?

1—Northwesterly curving to northeasterly.
2—Westerly, until encountering land, then easterly.
3—Counterclockwise over open water, then dissipating outward over land.

**6325.** (Refer to figure 120.) What was the local Central Standard Time of the surface report at Austin (AUS)?

1—11:53 a.m.
2—5:53 p.m.
3—10:53 p.m.

**6326.** (Refer to figure 120.) What type of report is listed for Dalhart (DHT)?

1—A report made by an automatic weather reporting system.
2—A special report concerning very low station pressure.
3—A record of a special report about a significant weather change.

**6327.** (Refer to figure 120.) What method was used to obtain the SP report at Marfa (MRF)?

1—Staffed AMOS station.
2—Automatic weather observing station (AMOS).
3—A military station observation of temperature, dewpoint, wind, and station pressure only.

**6328.** (Refer to figure 120.) What condition is reported at Childress (CDS)?

1—Distant heavy rain showers.
2—Heavy rain showers began 20 minutes after the hour.
3—The ceiling is solid overcast at an estimated 1,800 feet above sea level.

**6329.** (Refer to figure 120.) What condition is reported at Dallas (DAL)?

1—The station pressure is 1008.7 millibars.
2—Temperature/dewpoint spread is 16° C.
3—Altimeter setting is 30.07.

**6330.** (Refer to figure 120.) The pilot report at Fort Worth (FTW) indicates

1—several overcast layers including one above 9,500 feet.
2—a clear layer between 3,600 feet and 6,000 feet.
3—the base of an overcast layer at 7,500 feet.

**6331.** (Refer to figure 120.) The SP report at Galveston (GLS) indicates which condition?

1—Wind 170° magnetic at 5 knots.
2—No precipitation since last synoptic report.
3—Sea level pressure 1000.7 millibars.

**6332.** (Refer to figure 120.) What was the difference between the reported weather at Houston Hobby (HOU) and Houston International (IAH)?

1—HOU had a higher ceiling.
2—Wind direction was more southerly at IAH.
3—IAH had better visibility.

**6333.** (Refer to figure 120.) What weather improvement was reported at Lubbock (LBB) between 1750 and 1818 UTC?

1—The rain showers stopped.
2—The ceiling improved by 1,800 feet.
3—Visibility improved.

**6334.** (Refer to figure 120.) What cloud condition is indicated by a B-727 pilot over Lubbock (LBB)?

1—Ceiling was at 4,500 feet MSL.
2—Base of broken clouds was at 4,500 feet AGL.
3—Cloud tops varied between 5,300 feet and 6,000 feet MSL.

**6335.** (Refer to figure 120.) What weather condition is indicated by the report at Midland (MAF)?

1—Rain of unknown intensity was observed in the 090 to 180 quadrant.
2—The ceiling was at 25,000 feet MSL.
3—Wind was 020° magnetic at 20 knots.

**6336.** (Refer to figure 121.) What information is contained in the PIREP at San Antonio (SAT)?

1—Time of report was unknown.
2—Type of aircraft was unknown.
3—Top of the scattered layer was 4,000 feet AGL.

**6337.** (Refer to figure 121.) What change took place at Wichita Falls (SPS) between 1757 and 1820 UTC?

1—The rain became heavier.
2—Atmospheric pressure increased.
3—The ceiling lowered.

**6338.** (Refer to figure 121.) What was the ceiling at Fort Smith (FSM)?

1—8,000 feet AGL.
2—2,500 feet AGL.
3—2,900 feet MSL.

**6339.** (Refer to figure 121.) What change had taken place between 1755 and 1825 UTC at Harrison (HRO)?

1—Wind shifted from south to north-northwest.
2—Thundershowers began at 25 minutes after the hour.
3—Visibility reduced to IFR conditions.

**6340.** Runway visual range is measured in which of the following units?

1—Meters/1,000.
2—Feet/100.
3—Miles and fractions of miles.

**6341.** The purpose of the transmissometer is to measure

1—braking action on a wet runway.
2—the bases of obscuring precipitation.
3—the distance a pilot can see down the runway.

**6342.** Which measurement is reported as runway visibility?

1—Visibility reported by a ground observer from the airport control tower.
2—Slant range visibility in the landing area of the active runway.
3—Distance down the runway a pilot can see unlighted objects.

**6343.** What does the RVR value depicted on instrument approach procedure charts represent?

1—The horizontal distance a pilot can see high-intensity runway lights.
2—The horizontal distance down the runway a pilot can see unlighted objects.
3—The slant visual range a pilot will see down the final approach during landing.

**6344.** If squalls are reported at the destination airport, what wind conditions existed at the time?

1—Sudden increases in windspeed of at least 15 knots, lasting for at least 1 minute.
2—Peak gusts of at least 35 knots for a sustained period of 1 minute or longer.
3—Rapid variation in wind direction of at least 20° and changes in speed of at least 10 knots between peaks and lulls.

**6345.** Which type of weather can only be directly observed during flight and then reported in a PIREP?

1—Structural icing.
2—Jetstream type winds.
3—Level of the tropopause.

**6346.** What is indicated by a PIREP which is preceded in the Surface Weather Report by the letters "UUA"?

1—Unconfirmed PIREP.
2—Urgent PIREP.
3—PIREP from an unknown type aircraft and at an unknown flight altitude.

**6347.** Which pattern on a weather radar scope is an indication of a tornado?

1—A hook echo.
2—A line echo wave pattern.
3—An echo indicating severe hail.

**6348.** Weather satellite images show tropopause weather by reporting which reflections from the surface and clouds?

1—Ultraviolet and infrared reflections.
2—Infrared and visible light reflections.
3—Solar radiation and terrestrial radiation.

**6349.** What is the single source reference that contains information regarding frontal movement, turbulence, and icing conditions for a specific region?

1—Weather Depiction Chart.
2—Area Forecast.
3—Terminal Forecast.

**6350.** Which primary source contains information regarding the expected weather at the destination airport and at the ETA?

1—Low Level Prog Chart.
2—Radar Summary and Weather Depiction Charts.
3—Terminal Forecast.

**6351.** The body of a Terminal Forecast covers a geographical area within

1—a 5-mile radius of the center of a runway complex.
2—25 miles of the center of an airport.
3—10 miles of the station originating the forecast.

**6352.** The absence of a visibility entry in a Terminal Forecast specifically implies that the surface visibility

1—is at least 1 SM above the minimum visibility requirement for an approach to the primary instrument runway.
2—exceeds 6 SM.
3—is at least 15 SM in all directions from the center of the runway complex.

**6353.** What sources reflect the most accurate information on current and forecast icing conditions?

1—Low Level Sig Weather Prog Chart, RADAT's, and the Area Forecast.
2—PIREP's, Area Forecast, and the Freezing Level Chart.
3—PIREP's, AIRMET's, and SIGMET's.

**6354.** What weather is predicted by the term "TRW VICINITY" in a Terminal Forecast?

1—Thunderstorms are expected between 5 and 25 miles of the runway complex.
2—Rain showers may occur over the station and within 50 miles of the station.
3—Scattered thundershowers are predicted within the Terminal Control Area.

**6355.** (Refer to figure 122.) What weather is predicted at Alice TX (ALI) at 1500Z?

1—Marginal VFR due to ceilings.
2—Surface wind gusting to 25 knots.
3—Visibility 6 statute miles in haze.

**6356.** (Refer to figure 122.) The categorical outlook for Austin (AUS) indicates

1—marginal VFR due to ceilings and thunderstorms.
2—a chance of 1,000 feet AGL ceilings.
3—ceiling 1,400 broken and thunder showers.

**6357.** (Refer to figure 122.) At which time is IFR weather first predicted at Lubbock (LBB)?

1—1500Z.
2—1700Z.
3—0900Z.

**6358.** (Refer to figure 122.) What type conditions can be expected for a flight scheduled to land at San Angelo (SJT) at 1500Z?

1—Chance of 1 nautical mile visibility.
2—Occasional ceilings 800 feet in thunderstorms.
3—IFR conditions due to low ceilings, rain, and fog.

**6359.** (Refer to figure 123.) The weather system forecast from Tennessee to Texas is expected to be influenced by a

1—dry line producing thunderstorms.
2—warm front in the east and cold front in the west.
3—stationary front with moist, low-level flow.

**6360.** (Refer to figure 123.) The area forecast indicates that aviation weather hazards are predicted for

1—OK, AR, TN, AL, and TX.
2—TX, LA, MS, AR, and Coastal Waters.
3—OK, AR, LA, TN, MS, AL, TX, and Coastal Waters.

**6361.** (Refer to figure 123.) According to the forecast, the freezing level is expected to be

1—16,000 feet MSL with icing in south Texas.
2—13,000 feet MSL in northern Arkansas and Tennessee.
3—13,000 feet AGL in northern Oklahoma.

**6362.** (Refer to figure 123.) The forecast for IFR conditions in Texas and Oklahoma anticipates

1—ceilings of 1,000 feet MSL or less.
2—visibility restrictions due to fog.
3—turbulence in the stratus layers to as high as 24,000 feet MSL.

**6363.** (Refer to figure 123.) What is the categorical outlook for the areas of Texas and Oklahoma where thunderstorms are predicted?

1—Light rain and scattered, embedded thundershowers.
2—Cumulonimbus clouds with tops up to 35,000 feet MSL.
3—Ceilings lowering from 1,500-2,500 feet AGL to less than 1,000 feet AGL.

**6364.** (Refer to figure 123.) What weather is forecast for extreme Western Tennessee?

1—Mountains obscured by low stratus clouds and precipitation.
2—Generally ceilings 9,000 feet AGL, occasional ceilings 1,500-2,500 feet AGL.
3—IFR ceilings due to thunderstorms.

**6365.** TWEB Route Forecasts provide predicted weather for

1—a corridor 25 miles either side of a numbered cross-country route.
2—a 50-mile radius of the takeoff and landing airports.
3—any route of flight specified by the requesting pilot.

**6366.** How can the pilot obtain TWEB Route Forecast information?

1—From the TEL TWEB and Telephone Voice Response Systems (VRS).
2—From the ATIS and Pilots Automatic Telephone Weather.
3—From ARTCC and Automated Flight Service Station briefings.

**6367.** What information is provided by this TWEB Route Forecast excerpt?

249 TWEB 252317 GFK-MOI-ISN, GFK VCNTY CIGS AOA 5 THSD TILL 12Z...

1—Grand Forks (GFK) ceilings at or above 5,000 feet MSL.
2—Route No. 249, from GFK to MOI to ISN.
3—Ceilings within a 50-mile radius of Grand Forks (GFK) are 5,000 feet AGL.

**6368.** (Refer to figure 124.) Which system in the Convective Sigmet listing has the potential of producing the most severe storm?

1—The storms in Texas and Oklahoma.
2—The storms in Colorado, Kansas, and Oklahoma.
3—The isolated storm 50 miles northeast of Memphis (MEM).

**6369.** (Refer to figure 124.) What time period is covered by the outlook section of the Convective Sigmet?

1—24 hours after the valid time.
2—2 to 6 hours after the valid time.
3—No more than 2 hours after the valid time.

**6370.** Which type weather conditions are covered in the Convective Sigmet?

1—Embedded thunderstorms, lines of thunderstorms, and thunderstorms with 3/4 inch hail or tornadoes.
2—Cumulonimbus clouds with tops above the tropopause and thunderstorms with 1/2 inch hail or funnel clouds.
3—Any thunderstorm with a severity level of VIP 2 or more.

**6371.** (Refer to figure 125.) What approximate wind direction, speed, and temperature (relative to ISA) are expected for a flight over OKC at FL370?

1—265° true; 27 knots; ISA +1° C.
2—260° true; 27 knots; ISA +6° C.
3—260° magnetic; 27 knots; ISA -5° C.

**6372.** (Refer to figure 125.) What approximate wind direction, speed, and temperature (relative to ISA) are expected for a flight over TUS at FL270?

1—347° magnetic; 5 knots; ISA -10° C.
2—350° true; 5 knots; ISA +5° C.
3—010° true; 5 knots; ISA +13° C.

**6373.** (Refer to figure 125.) What approximate wind direction, speed, and temperature (relative to ISA) are expected for a flight over INK at 16,000 feet?

1—025° magnetic; 7 knots; ISA -10° C.
2—035° true; 8 knots; ISA +5° C.
3—030° true; 7 knots; ISA +15° C.

**6374.** (Refer to figure 125.) What approximate wind direction, speed, and temperature (relative to ISA) are expected for a flight over JAN at FL350?

1—230° true; 2 knots; ISA +10° C.
2—295° true; 8 knots; ISA -10° C.
3—230° magnetic; 3 knots; ISA +5° C.

**6375.** (Refer to figure 125.) What approximate wind direction, speed, and temperature (relative to ISA) are expected for a flight over MKC at FL260?

1—260° true; 43 knots; ISA +10° C.
2—260° true; 45 knots; ISA -10° C.
3—260° magnetic; 42 knots; ISA +9° C.

**6376.** (Refer to figure 125.) What will be the wind and temperature trend for a HOU-DAL-OKC flight at FL390?

1—Wind direction shift from north to west.
2—Windspeed increase.
3—Temperature decrease.

**6377.** (Refer to figure 125.) What will be the wind and temperature trend for a SAT-ELP-TUS flight at 16,000 feet?

1—Temperature decrease slightly.
2—Windspeed decrease.
3—Wind direction shift from southeast to east.

**6378.** (Refer to figure 125.) What will be the wind and temperature trend for a STL-MEM-MSY flight at FL330?

1—Windspeed decrease.
2—Wind shift from west to north.
3—Temperature increase 5° C.

**6379.** (Refer to figure 125.) What will be the wind and temperature trend for a DEN-ICT-OKC flight at 11,000 feet?

1—Temperature decrease.
2—Windspeed increase slightly.
3—Wind shift from calm to a westerly direction.

**6380.** (Refer to figure 125.) What will be the wind and temperature trend for a DSM-LIT-SHV flight at 12,000 feet?

1—Windspeed decrease.
2—Temperature decrease.
3—Wind direction shift from northwest to southeast.

**6381.** (Refer to figure 125.) What is the forecast temperature at ATL for the 3,000-foot level?

1— +6° C.
2— +6° F.
3— Not reported.

**6382.** What wind direction and speed aloft are forecast by this FD report for FL390 - "750649"?

1—350° at 64 knots.
2—250° at 106 knots.
3—150° at 6 knots.

**6383.** What wind direction and speed aloft are forecast by this FD report for FL390 - "731960"?

1—230° at 119 knots.
2—131° at 96 knots.
3—073° at 196 knots.

**6384.** (Refer to figure 126.) Which marginal VFR condition was reported in north-central Wyoming?

1—Sky obscured, visibility restricted by smoke.
2—Sky partially obscured, ceiling 2,000 feet, visibility 5 miles in haze.
3—Broken ceiling measured at 200 feet.

**6385.** (Refer to figures 126 and 127.) Which conditions caused the IFR weather which was reported in West Virginia?

1—Heavy thundershowers.
2—Visibility 2-4 miles in rain.
3—Sky obscured, visibility less than 1 mile in fog.

**6386.** (Refer to figures 126 and 127.) The IFR conditions behind the cold front in central Georgia were mostly a result of

1—continuous rain and low ceilings.
2—thunderstorms with tops over 30,000 feet.
3—warm, moist air flowing inland from Atlantic coastal waters.

**6387.** (Refer to figures 126 and 127.) The thunderstorm area in northern Georgia was moving

1—the same direction as the cold front.
2—north-northeast at 20 knots.
3—southeast with tops of 21,000 feet.

**6388.** (Refer to figures 126 and 127.) A flight from New Orleans to central Florida over the Gulf from 1000Z to 1135Z would probably have encountered

1—IFR conditions with continuous rain, conditions improving after passing the cold front.
2—strong to very strong thunderstorms with tops of 30,000 feet or higher.
3—marginal VFR conditions with thundershower intensity decreasing.

**6389.** (Refer to figure 127.) The thunderstorm area approaching the Washington, DC vicinity from Virginia was moving

1—northeast at 30 knots.
2—north at 17 knots.
3—north-northeast at 15 knots.

**6390.** (Refer to figures 126 and 127.) A flight planned from Washington, DC to Atlanta (north-central Georgia) at 1200Z should expect

1—thunderstorms with tops in the vicinity of 21,000 feet.
2—a wind shift because of passing through a cold front.
3—VFR or marginal VFR conditions for the entire flight.

**6391.** (Refer to figures 126 and 127.) The IFR weather off the New Jersey shore and approaching New York City in the warm front included

1—a strong thunderstorm area moving northeast at 10 knots.
2—a VIP 3 to 4 thunderstorm area with a cell top of 27,000 feet.
3—marginal VFR conditions with ceilings of 6,000 feet, visibility 5 miles in light fog.

**6392.** (Refer to figure 127.) The thunderstorms in the Gulf to the south of the western Florida panhandle contained

1—a very strong storm area with all tops above 40,000 feet.
2—thunderstorms with little movement and tops of 18,000 feet.
3—at least one strong to very strong cell with a top above the tropopause.

**6393.** (Refer to figure 126.) The cold front stretching from the Great Lakes to the Texas Panhandle is drawn to show its position

1—6 hours after the chart was issued.
2—1 hour before the reported IFR and MVFR contour line positions.
3—1 hour before the forecast weather at each reporting station.

**6394.** (Refer to figures 126 and 127.) Which conditions were reported by those stations in Arizona which did not report clear skies?

1—Breaks in the overcast.
2—Scattered to broken clouds.
3—Radar observations unavailable.

**6395.** (Refer to figures 126 and 127.) The IFR conditions in the vicinity of Lakes Superior, Huron, and Michigan were caused by

1—overcast sky and haze.
2—convective action during the cold front passage.
3—obscured skies and fog.

**6396.** What is a feature of the Radar Summary Chart?

1—Severe weather watches are shown for the valid time.
2—Tops and bases of all cloud cover in the reporting area are shown.
3—Predicted location of solid thunderstorm lines are highlighted.

**6397.** A Weather Depiction Chart indicates

1—actual sky cover, visibility restrictions, and type of precipitation at reporting stations.
2—forecast ceilings and visibilities over a large geographic area.
3—actual en route weather conditions between reporting stations.

**6398.** What is indicated on the Weather Depiction Chart by a continuous smooth line enclosing a hatched geographic area?

1—The entire area has ceilings less than 1,000 feet and/or visibility less than 3 miles.
2—More than 50 percent of the area enclosed by the smooth line is predicted to have IFR conditions.
3—Reporting stations within the enclosed area are all showing IFR conditions at the time of the report.

**6399.** For the most effective use of the Radar Summary Chart a flight planner should

1—consult the chart to obtain the most accurate measurement of freezing levels, cloud cover, and wind conditions between reporting stations.
2—compare the chart information with the Weather Depiction Chart to get a three-dimensional picture of clouds and precipitation.
3—analyze the chart for information on ceilings, cloud tops, and cloud coverage between reporting stations.

**6400.** What information is provided by the Radar Summary Chart that is not shown on other weather charts?

1—Lines and cells of hazardous thunderstorms.
2—Types of precipitation between reporting stations.
3—Ceilings and precipitation between reporting stations.

**6401.** (Refer to figure 128.) Which conditions are predicted for southern Florida on the 24-Hour Surface Prognostic Chart?

1—Moderate to severe turbulence over more than half the area.
2—Rain showers and thunderstorms over less than half the area.
3—MVFR flight conditions.

**6402.** (Refer to figure 128.) The warm front along the southeast states coastal areas will be producing

1—showery precipitation covering half or more of the area.
2—continuous IFR conditions with rain and thundershowers.
3—high winds due to hurricane Florence.

**6403.** (Refer to figure 128.) What type weather will be associated with the cold front depicted from Canada through the south-central states?

1—Convective activity in Texas and Oklahoma.
2—Moderate turbulence and scattered rain showers in the Great Lakes area.
3—Continuous rain and rain showers in south-central Canada.

**6404.** (Refer to figure 128.) What type turbulence is expected in the southeastern state area?

1—Light to moderate turbulence up to the 240 millibar level.
2—Severe clear air turbulence up to FL240.
3—Moderate to severe turbulence from the surface to 24,000 feet MSL.

**6405.** (Refer to figure 128.) The freezing level in the Lake Michigan area is forecast to be

1—above the turbulence level.
2—at the surface.
3—at the 120 millibar level.

**6406.** (Refer to figure 128.) What type weather is associated with the low-pressure areas in California?

1—Moderate turbulence up to 12,000 feet MSL.
2—Low ceilings due to the approaching cold front.
3—Unusually low barometric pressure.

**6407.** (Refer to figure 128.) What is the forecast activity of the trough in eastern Montana during the 0000Z to 1200Z period?

1—Completely dissipate due to the strengthening high-pressure area.
2—Move southward and merge with the western half of the cold front.
3—Move eastward into the Lake Superior area.

**6408.** (Refer to figure 128.) Which location includes a prediction of continuous rain?

1—Central Gulf of Mexico.
2—South-central Canada.
3—Coastal areas of Georgia and the Carolinas.

**6409.** (Refer to figure 128.) What weather information is shown for the storm system which has been named "Florence"?

1—The system is a tropical cyclone with no associated thunderstorms.
2—The system will develop to hurricane strength between 0000Z and 1200Z Sep 09.
3—The storm is moving toward and merging with the warm front.

**6410.** (Refer to figure 128.) What are the lowest and highest sea level atmospheric pressures predicted on the 24-Hour Surface Prog Chart?

1—1006.0 millibars to 1016.0 millibars.
2—1000.0 millibars to 1018.0 millibars.
3—1004.0 millibars to 1011.8 millibars.

**6411.** Freezing Point Depressant (FPD) fluid is intended to be applied

1—as an anti-ice and deice medium before takeoff.
2—during flight, to wings and critical surfaces not protected by a hot air anti-ice system.
3—on the ground during snow or freezing rain to all air carrier airplanes and helicopters.

**6412.** The effectiveness of applied Freezing Point Depressant (FPD) fluid during snow or freezing precipitation will

1—remain at full strength until takeoff.
2—deteriorate as water is absorbed in the FPD film.
3—become better as hot air type anti-ice systems are activated during the taxi-out period.

**6413.** Which source is recommended for an initial look at the weather expected for a planned flight?

1—En Route Flight Advisory Service (EFAS).
2—Hazardous In-Flight Weather Advisory Service (HIWAS)
3—A.M. Weather Telecast on PBS.

**6414.** What method can be used to get recorded weather information from the Interim Voice Response System (IVRS)?

1—Contact the AFSS on a local or long distance telephone line for a personal briefing.
2—Use a touch-tone telephone and follow recorded menu instructions.
3—Contact the local FSS using a rotary dial telephone and follow recorded instructions.

**6415.** What basic information is provided automatically by the Interim Voice Response System (IVRS) recording?

1—Surface Observations, Terminal Forecasts, Winds Aloft Forecasts, and Selected Weather Warnings.
2—Terminal Forecasts, Radar Summaries, Weather Depiction, and AIRMET's.
3—Observed weather at the takeoff and landing airports, and current ATIS recordings.

**6416.** What information does the pilot supply to obtain recorded weather related to the flight from the Interim Voice Response System (IVRS)?

1—Telephone number where the FSS briefer can contact the pilot.
2—Location identifiers (LOCIDS), route, altitude, and times for the flight.
3—Flight information in the same order as on the FAA Flight Plan Form.

**6417.** An unscheduled air traffic advisory, for use by air carrier crews to anticipate and avoid adverse weather at a busy terminal is known as

1—center weather advisories (CWA).
2—severe weather watch bulletins (WW).
3—special flight forecasts (SFF).

**6418.** Which forecast provides specific information concerning expected sky cover, cloud tops, visibility, weather, and obstruction to vision in a route format?

1—DFW FA 131240.
2—249 TWEB 252317.
3—CHI WA 300300.

**6419.** Forecast winds and temperatures aloft for an international flight may be obtained by consulting

1—Area Forecasts published by the departure location host country.
2—the current International Weather Depiction Chart appropriate to the route.
3—Wind and Temperature Aloft Charts prepared by a Regional Area Forecast Center (RAFC).

**6420.** How will an area of thunderstorm activity, that may grow to severe intensity, be indicated on the Severe Weather Outlook Chart?

1—SLGT within cross-hatched areas.
2—APCHG within any area.
3—SVR within any area.

**6421.** For international flights, a High Level Significant Prognostic Chart is prepared for use at

1—any flight level above 290.
2—FL250 to FL600.
3—FL180 to FL600.

**6422.** The Low Level Prognostic Chart depicts weather conditions

1—that are forecast to exist at a specific time shown on the chart.
2—as they existed at the time the chart was prepared.
3—that are forecast to exist 6 hours after the chart was prepared.

**6423.** A station is forecasting wind and temperature aloft to be 280° at 205 knots; temperature -51° C at FL390. How would this data be encoded in the FD?

1—7800-51.
2—789951.
3—280051.

**6424.** At what time are current AIRMET's broadcast in their entirety by the AFSS?

1—15 minutes after the hour only.
2—Every 15 minutes until the AIRMET is canceled.
3—15 and 45 minutes after the hour during the first hour after issuance.

**6425.** If a SIGMET alert is announced, how can information contained in the SIGMET be obtained?

1—ATC will announce the hazard and advise when information will be provided in the FSS broadcast.
2—By contacting a weather watch station.
3—By contacting the nearest AFSS.

**6426.** What type service should normally be expected from an En Route Flight Advisory Service?

1—Weather advisories pertinent to the type of flight, intended route of flight, and altitude.
2—Severe weather information, changes in flight plans, and receipt of position reports.
3—Radar vectors for traffic separation, route weather advisories, and altimeter settings.

**6427.** Below FL180, en route weather advisories should be obtained from an FSS on

1—122.1 MHz.
2—122.0 MHz.
3—123.6 MHz.

**6428.** What type turbulence should be reported when it causes slight, rapid, and somewhat rhythmic bumpiness without appreciable changes in attitude or altitude, less than one-third of the time?

1—Occasional light chop.
2—Moderate turbulence.
3—Moderate chop.

**6429.** What type turbulence should be reported when it causes changes in altitude and/or attitude more than two-thirds of the time, with the aircraft remaining in positive control at all times?

1—Continuous severe chop.
2—Continuous moderate turbulence.
3—Intermittent moderate turbulence.

**6430.** What type turbulence should be reported when it momentarily causes slight, erratic changes in altitude and/or attitude, one-third to two-thirds of the time?

1—Occasional light chop.
2—Moderate chop.
3—Intermittent light turbulence.

**6431.** (Refer to figures 129 through 131.) What is the wind velocity at 39,000 feet around the low pressure center in Canada?

1—10 knots.
2—20 knots.
3—30 knots.

**6432.** (Refer to figure 129.) Which area has the greatest potential for condensation as inferred by the temperature/dewpoint spread on the 500 MB Constant Pressure Chart?

1—Along the Oregon and California coast.
2—Western U.S. along the 55880 meter height contour.
3—Around the low pressure center in Canada.

**6433.** (Refer to figures 129 through 131.) Which flight level should afford the best wind conditions for a northbound flight along the California Coast?

1—FL180.
2—FL280.
3—FL380.

**6434.** (Refer to figure 131.) What is the height of the 200 MB level at the low-pressure center in Canada?

1—1,850 meters MSL.
2—18,500 meters MSL.
3—11,850 meters MSL.

**6435.** (Refer to figure 130.) What is the height of the 300 MB level at the low pressure center in Canada?

1—9,120 meters MSL.
2—18,000 meters MSL.
3—11,850 meters MSL.

**6436.** Interpret the path of the jetstream from figures 129 through 131.

1—Southern California, Nevada, Utah, Nebraska/Kansas, and then southeastward.
2—Oregon, Idaho, Wyoming, Nebraska, Iowa, and across the Great Lakes.
3—The Alaska area, across Canada to Montana, North Dakota, then across the Great Lakes area.

**6437.** The system depicted on the 500 MB chart, figure 129, that is approaching the California Coast from the west is a

1—LOW.
2—HIGH.
3—cold front.

**6438.** What type weather is inferred by the almost vertical extent of the LOW in Canada as depicted in figures 129 through 131?

1—A rapid moving system with little chance of developing cloudiness, precipitation, and adverse flying conditions.
2—A slow moving storm which may cause extensive and persistent cloudiness, precipitation, and generally adverse flying weather.
3—A rapid moving storm, leaning to west with altitude, which encourages line squalls ahead of the system with a potential of severe weather.

**6439.** (Refer to figures 129 through 131.) What is the approximate temperature for a flight from southern California to central Kansas at FL350?

1— -16° C.
2— -39° C.
3— -41° C.

**6440.** (Refer to figures 129 through 131.) Determine the approximate wind direction and velocity at FL240 over the station in central Oklahoma.

1—280° at 10 knots.
2—320° at 10 knots.
3—330° at 13 knots.

**6441.** (Refer to figures 129 through 131.) What is the relative moisture content of the airmass approaching the California coast?

1—Dry.
2—Moist enough for condensation.
3—Very wet with high potential for clouds and precipitation.

**6442.** (Refer to figures 129 through 131.) What movement of the LOW in Mexico is inferred by the winds plotted on the Constant Pressure Charts?

1—Very slow movement.
2—Rapid movement.
3—Northward movement.

**6443.** (Refer to figure 129.) What change in height of the 500 MB level over central Oklahoma has occurred in the last 12 hours?

1—Lowered 300 meters.
2—Raised 30 meters.
3—Raised 20 meters.

**6444.** From figures 132A through 132D, determine an area of potential wind shear.

1—South central Canada.
2—Northeast United States coast and Canada.
3—Over the Pacific Ocean west of the United States coast.

**6445.** (Refer to figures 132A through 132D.) What is the direction of windflow along the United States Atlantic coast?

1—Westerly.
2—Northeasterly.
3—Southwesterly.

**6446.** From figures 132A through 132D, determine the forecast position of the jetstream at the tropopause.

1—From the California/Mexico border eastward across the southern states and over the Atlantic Ocean east of Florida.
2—From central California eastward across the United States and northeastward across the Atlantic Ocean from North Carolina.
3—From the Alaska area southeastward to Montana and North Dakota, across the Great Lakes to New York and then northeast over the Atlantic.

**6447.** (Refer to figures 132A through 132D.) What vertical wind shear can be expected at the tropopause on a line from the Great Lakes to Florida?

1—60 knots.
2—30 knots.
3—2 knots.

**6448.** (Refer to figures 132A through 132D.) What is the approximate height of the tropopause over most of the United States?

1—35,000 to 45,000 feet.
2—45,000 to 50,000 feet.
3—Over 50,000 feet.

**6449.** (Refer to figures 132A through 132D.) What are the strongest observed winds at the tropopause?

1—70 knots.
2—80 knots.
3—90 knots.

**6450.** (Refer to figure 132C.) What are the coverage and vertical extent of the isolated embedded thunderstorms over the southeastern United States?

1—one-eighth to five-eighths coverage, surface to FL420.
2—one-eighth to five-eighths coverage, below FL240 to FL450.
3—Less than one-eighth coverage, below FL240 to FL420.

**6451.** (Refer to figure 132C.) The large arrow over the north-central, United States depicts

1—the jetstream to be 90 knots west-southwest at 37,000 feet.
2—thunderstorm movement with winds in the thunderstorms at 90 knots.
3—strongest winds at the tropopause to be 90 knots from west-southwest.

**6452.** (Refer to figure 132C.) What turbulence is expected in the Florida area as implied by the High Level Significant Weather Chart?

1—Light to moderate.
2—Moderate or greater.
3—Severe.

**6453.** The shaded area labeled "MDT" in figures 133A and 133B represents

1—moderate intensity thunderstorms.
2—severe thunderstorms with a coverage of 6 to 10 percent of the area.
3—moderate weather with embedded thunderstorms of unknown intensity.

**6454.** (Refer to figures 133A and 133B.) What is the primary purpose of the Severe Weather Outlook charts?

1—Advanced planning for future storm development.
2—Specific information on intensity of severe weather.
3—Positive information on severe weather in progress.

**6455.** (Refer to figures 133A and 133B.) In what areas are probable general thunderstorm activity forecast?

1—In the shaded area labeled "LGT."
2—Between the two lines with an arrowhead.
3—On the east of each line with an arrowhead.

**6456.** What information is indicated by the note, "APCHG" in figure 133A?

1—Approaching storms are forecast to have large hail 3/4-inch in diameter.
2—Approaching storms deteriorating with clearing the next 12 hours.
3—Probable general thunderstorm activity may approach severe intensity.

**6457.** Convergence on a grid chart is defined as the angle between

1—grid north and true north.
2—magnetic north and true north.
3—grid north and magnetic north.

**6458.** An ISOGRIV is defined correctly by which of the following responses? Line of

1—equal grivation.
2—equal variation.
3—zero grivation.

**6459.** Which chart projection is most commonly used for grid flights in subpolar areas?

1—Lambert conformal.
2—Gnomonic.
3—Mercator.

**6460.** Grid meridians often are parallel to the

1—Equator.
2—180° meridian.
3—Greenwich Meridian.

**6461.** Which chart projection is used only for planning grid polar flights?

1—Transverse Mercator.
2—Polar stereographic.
3—Polar gnomonic.

**6462.** Which chart projection is most commonly used for aeronautical navigation?

1—Mercator.
2—Lambert conformal.
3—Stereographic.

**6463.** Which features are associated with the Lambert Conformal Conic Projection?

1—A straight line approximates a great circle.
2—Meridians are straight lines, equally spaced.
3—Straight lines cross meridians at constant angles.

**6464.** Which publication deals solely with solutions concerning selected stars?

1—H.O. Pub. No. 249, Sight Reduction Tables, Volume I.
2—H.O. Pub. No. 249, Sight Reduction Tables, Volume II.
3—H.O. Pub. No. 249, Sight Reduction Tables, Volume III.

**6465.** How are select stars that are best suited for fixing purposes identified in the H.O. Pub. No. 249, Sight Reduction Tables?

1—Name printed in bold type.
2—Marked by a number symbol.
3—Marked by diamonds.

**6466.** Precession and nutation corrections are only applied to

1—the Moon.
2—select stars.
3—the Sun.

**6467.** Nutation is defined as

1—bending of the light as it passes through the atmosphere.
2—error caused by mechanical faults in the sextant.
3—nodding or wobbling of the Earth on its axis.

**6468.** When is parallax error the greatest?

1—When the body being observed is on the horizon.
2—When the HS is greatest (i.e., close to 90).
3—When the altitude of the observer aircraft is high.

**6469.** A parallax correction is applied to a celestial observation of the

1—Sun.
2—planets.
3—Moon.

**6470.** What causes refraction error in a sextant?

1—Improper alignment of the optical system in the sextant.
2—Poorly aligned sextant mount in the aircraft.
3—Bending of the light as it passes through the atmosphere.

**6471.** How is the correction for a refraction error applied to the HS (height sighted)?

1—Subtracted for Moon observations only.
2—Subtracted for all celestial observations.
3—Added for Sun, Moon, and the planets.

**6472.** When observing the Moon HS, which corrections are always additive?

1—Index.
2—Parallax.
3—Refraction.

**6473.** When observing the Moon HS, which correction is always subtracted?

1—Index.
2—Parallax.
3—Refraction.

**6474.** Why is the intercept method used to plot celestial fixes?

1—It provides a rapid means of computing the observations.
2—It eliminates the need to correct for precision.
3—The subpoint of most bodies would be too far to plot on most aeronautical charts.

**6475.** What measurement does the intercept method provide when determining an LOP for a celestial fix?

1—Nautical miles between the actual circle of equal altitude and that of the assumed position.
2—Nautical miles between the position and the celestial body's nadir.
3—The distance in nautical miles between the position and the celestial body's subpoint.

**6476.** Noonday fixes (local apparent noon) can best be obtained at

1—lower latitudes.
2—middle latitudes.
3—higher latitudes.

**6477.** How can latitude be determined from a celestial observation of Polaris?

1—By applying a Coriolis correction to the HO (observed altitude).
2—By applying a "Q" correction to the HO (observed altitude).
3—By using the formula R = RO X f.

**6478.** A line extending southward from the western side of the square of Pegasus leads to the star

1—Diphda.
2—Fomalhaut.
3—Achenar.

**6479.** The first magnitude star approximately midway between Betelgeuse and the Pleiades is

1—Elnath.
2—Pollux.
3—Aldebaran.

**6480.** The star at the end of the handle of the Little Dipper (URSA minor) is

1—Dubhe.
2—Kochab.
3—Polaris.

**6481.** The star at the tail of Scorpius (the scorpion) is

1—Shaula.
2—Antares.
3—Nunki.

**6482.** To determine latitude by an observation of Polaris, it is necessary to adjust the HO altitude

1—to the altitude of the poles.
2—for erratic orbit of Polaris.
3—for change in LHA of Aries.

**6483.** The correction used during a Polaris observation is

1—Q correction.
2—motion of the body.
3—index error.

**6484.** Which of the listed planets is most often used for a celestial observation?

1—Mercury.
2—Uranus.
3—Pluto.

**6485.** Which planet is most often used for celestial observations?

1—Uranus.
2—Mars.
3—Pluto.

**6486.** The celestial reference lines that are counterparts of parallels of latitude are called

1—declination circles.
2—hour circles.
3—diurnal circles.

**6487.** At what location are all celestial bodies circumpolar?

1—30°.
2—60°.
3—Either pole.

**6488.** At what location are none of the celestial bodies circumpolar?

1—The Equator.
2—30°.
3—60°.

**6489.** What is the name of the celestial counterpart for longitude?

1—Declination.
2—Hour circles.
3—Diurnal circles.

**6490.** What is the name of the point directly above the observer's position on the celestial sphere?

1—Nadir.
2—Zenith.
3—Aries.

**6491.** From which publication can the GHA of the Sun, Moon, planets, and Aries be obtained?

1—H.O. Pub. No. 216, Air Navigation.
2—H.O. Pub. No. 249, Sight Reduction Tables, Volume I.
3—Air Almanac.

**6492.** How is the first point of Aries defined?

1—Point where the Sun crosses the observer's upper branch.
2—Point where the Sun appears to cross the celestial Equator from north to south.
3—Point where the Sun appears to cross the celestial Equator from south to north.

**6493.** What is the LHA of a celestial body using the following information?

| | |
|---|---|
| Longitude of the observer | 65° E |
| GHA Aries | 38° |
| SHA of an observed body | 47° |

1—85°.
2—150°.
3—330°.

**6494.** What is the LHA of a celestial body using the following information?

| | |
|---|---|
| Longitude of the observer | 35° W |
| GHA Aries | 95° |
| SHA of an observed body | 45° |

1—45°.
2—105°.
3—140°.

**6495.** Time of transit refers to

1—the altitude of a body above the observer's celestial horizon.
2—the time when a body passes the observer's meridian.
3—when the Sun passes overhead in the sky.

**6496.** A 1-hour time zone is equal to how many degrees or minutes of longitude on the Earth's surface?

1—15°.
2—1°.
3—15 minutes.

**6497.** How many degrees of longitude does the mean Sun travel in 3 hours 20 minutes?

1—45°.
2—50°.
3—55°.

**6498.** How many degrees of longitude does the mean Sun travel in 2 hours 40 minutes?

1—35°.
2—40°.
3—45°.

**6499.** Sidereal time is defined as

1—time measured by reference to the upper branch of the first point of Aries.
2—when the Sun passes from north to south declination across the equinoctial.
3—time measured from the Greenwich Meridian to the observer's lower branch.

**6500.** Where should the course be measured when plotting on a Lambert Conformal Chart?

1—Any longitude.
2—Mid-longitude.
3—Mid-latitude.

**6501.** On which chart does a straight line represent a rhumb line?

1—Mercator.
2—Lambert conformal.
3—Stereographic.

**6502.** True airspeed is defined as the

1—reading taken from the airspeed indicator.
2—indicated airspeed corrected for pitot-static error.
3—calibrated or equivalent airspeed corrected for temperature and pressure altitude.

**6503.** Calibrated airspeed is defined as the

1—indicated airspeed corrected for pitot-static error.
2—indicated airspeed corrected for compressibility.
3—calibrated or equivalent airspeed corrected for temperature and pressure altitude.

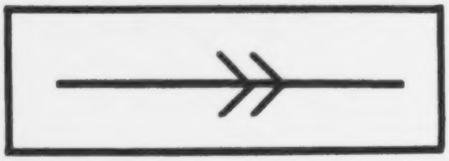
**6504.** Track is defined as the

1—intended horizontal direction of travel of an aircraft over the ground.
2—horizontal component of the actual path of an aircraft over the ground.
3—horizontal component of the intended path of the aircraft comprising both direction and magnitude.

**6505.** An AP (air position) is defined as

1—a point on the Earth established by keeping an accurate account of time, groundspeed, and track since the last known position.
2—an accurate position determined by electronic equipment.
3—the location of an aircraft in relation to the airmass surrounding it.

**6506.** The following symbol represents



1—an air position.
2—a ground track.
3—a wind vector.

**6507.** How is Doppler groundspeed determined?

1—By comparing the frequency from the forward beam with the frequency from the aft beam.
2—By the automatic astrotracker.
3—By comparing electronic signals sent from a master station with those received from a slave station.

**6508.** The Doppler system provides

1—true airspeed.
2—true air temperature.
3—drift angle and groundspeed.

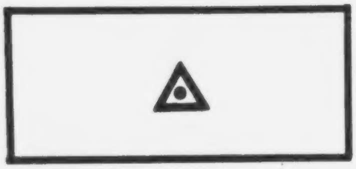
**6509.** Which is a basic component of an INS?

1—Antenna.
2—Accelerometer.
3—Amplifier.

**6510.** The key to a successful inertial system is

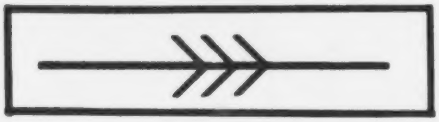
1—absolute accuracy in measuring horizontal acceleration.
2—ability to maintain a constant reference to true north.
3—synchronization of signals.

**6511.** The following symbol represents



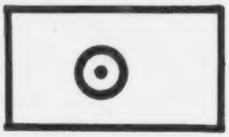
1—a DR position.
2—an air position.
3—a fix.

**6512.** The following symbol represents



1—an air vector.
2—an air position.
3—a wind vector.

**6513.** The following symbol represents



1—a DR position.
2—an air vector.
3—a wind vector.

**6514.** With a relative bearing of 095°, a compass heading of 303°, and a local variation of 2° west, what is the true bearing TO the NDB?

| | | | | | | |
|---|---|---|---|---|---|---|
| FOR (MAGNETIC) | N | 30 | 60 | E | 120 | 150 |
| STEER (COMPASS) | 0 | 28 | 57 | 86 | 117 | 148 |
| FOR (MAGNETIC) | S | 210 | 240 | W | 300 | 330 |
| STEER (COMPASS) | 180 | 212 | 243 | 274 | 303 | 332 |

1—033°.
2—037°.
3—213°.

**6515.** With a relative bearing of 120°, a compass heading of 212°, and a local variation of 9° west, what is the true bearing TO the NDB?

| | | | | | | |
|---|---|---|---|---|---|---|
| FOR (MAGNETIC) | N | 30 | 60 | E | 120 | 150 |
| STEER (COMPASS) | 0 | 28 | 57 | 86 | 117 | 148 |
| FOR (MAGNETIC) | S | 210 | 240 | W | 300 | 330 |
| STEER (COMPASS) | 180 | 212 | 243 | 274 | 303 | 332 |

1—141°.
2—159°.
3—321°.

**6516.** A Schuler-tuned inertial system

1—dampens drift input.
2—measures horizontal acceleration.
3—prevents errors caused by gravity.

**6517.** When the star Alpheratz is on the upper branch of an observer's meridian, what is the Local Sidereal Time?

1—0000.
2—0600.
3—1200.

**Flight Navigator Problem No. 1, Part 1 — Jacksonville, Florida, to Bermuda Island — Preflight Planning.** NOTE: Flight navigator applicants must provide their own plotters, dividers, computers, flight logs, and celestial forms. They may provide their own charts (GNC 9 or equivalent) or may use a copy of the charts, figures 154, 155, 156, 157 and Celestial Charts, figures 134 through 153. The test monitor will assure that the logs, forms, and charts are free of markings that would compromise the test. The monitor will also determine that the applicant's computer is acceptable.

Instructions for Preflight Planning Problem No. 1, Part 1:

1. Zero deviation will be used, i.e., compass heading and magnetic heading are the same.
2. Preflight a trip from Jacksonville, Florida, VORTAC (30°27'N—081°33'W) to Bermuda VOR (32°21'N—064°41'W) via direct route. Estimated time of departure (EDT) is 2100Z, September 19, 1978. The flight is planned for FL190 and 200 KTAS.
3. Winds aloft are forecast as follows:
    a. 30°30'N-081°00'W — 200°, 30 knots.
    b. 31°00'N-078°30'W — 225°, 35 knots.
    c. 31°00'N-076°00'W — 245°, 20 knots.
    d. 32°00'N-071°30'W — 285°, 30 knots.
    e. 32°00'N-069°00'W — 305°, 35 knots.
    f. 32°00'N-000°30'W — 325°, 40 knots.
4. Using the forecast winds given in item 3, develop a preflight log for the following legs:
    a. Jacksonville VORTAC to 080°00'W.
    b. 080°00'W to 077°30'W.
    c. 077°30'W to 075°00'W.
    d. 075°00'W to 072°30'W.
    e. 072°30'W to 070°00'W.
    f. 070°00'W to 067°30'W.
    g. 067°30'W to Bermuda VOR.
5. Answer questions 6518 through 6521 by referring to your preflight log and calculations.

**6518.** (Refer to instructions 1 through 5 for Part 1.) What is the magnetic heading shown on the preflight log for the leg from 077°30'W to 075°00'W?

1—085°.
2—090°.
3—095°.

**6519.** (Refer to instructions 1 through 5 for Part 1.) What is the preflight groundspeed for the leg from 072°30'W to 070°00'W?

1—228 knots.
2—232 knots.
3—237 knots.

**6520.** (Refer to instructions 1 through 5 for Part 1.) What is the preflight ETE from Jacksonville VORTAC to Bermuda VOR?

1—3 hours 56 minutes.
2—4 hours 03 minutes.
3—4 hours 06 minutes.

**6521.** (Refer to instructions 1 through 5 for Part 1.) What is the preflight distance from Jacksonville VORTAC to Bermuda VOR?

1—852 NM.
2—860 NM.
3—868 NM.

**Flight Navigator Problem No. 1, Part 2 — Jacksonville, Florida, to Bermuda Island — En Route.**

Instructions for En Route Planning Problem No. 1, Part 2:

1. See figures 134 through 153 for required celestial data and tables.

2. Alter headings, when instructed, at specified fix positions.

3. Navigation aids:

    a. Jacksonville VORTAC — 30°27′N — 081°34′W.
    b. Johns Island NDB — 32°42′N — 080°00′W.
    c. Bermuda VOR — 32°21′N — 064°42′W.
    d. Grand Bahama NDB — 26°38′N — 078°22′W.

4 Complete the following scenario and answer the en route questions by referring to your preflight logs and calculations (Part 1)

    a. Depart Jacksonville VORTAC at 2130Z, level 19,000 feet, 200 KTAS, magnetic heading 089°.

        (1) Pressure altitude — 19,025 feet. (Assume altitude readings are taken over water.)
        (2) Absolute altitude — 20,150 feet. (Assume altitude readings are taken over water.)

    b. Compute an ETA for crossing the 80°00′W longitude on the first leg using preflight winds.

    c. Determine position at 2220Z based on the following data:

        (1) Johns Island (JZI) NDB indicates a 319° magnetic bearing to the station.
        (2) Pressure altitude — 19,000 feet.
        (3) Absolute altitude — 20,285 feet.
        (4) The Sun is observed with an HS of 10°45′.

    d. Alter heading to next position (31°24′N — 075°00′W) from the 2220Z fix position (disregard the DR position).

    e. Determine the position at 2310Z based on the following data:

        (1) Polaris is observed with an HS of 31°19′ at 2306Z.
        (2) Venus is observed with an HS of 16°33′ at 2310Z.
        (3) Grand Bahama (GBN) NDB indicates a 223° magnetic bearing to the station.
        (4) Pressure altitude — 19,000 feet.
        (5) Absolute altitude — 20,575 feet.

(NOTE: Expect jetstream influence on this leg.)

    f. Alter heading to next position (31°55′N — 070°00′W) from the 2310Z position (disregard the DR position).

    g. Determine the position at 0000Z based on the following data:

        (1) Alpheratz is observed with an HS of 28°11′ at 0000Z.
        (2) Alkaid is observed with an HS of 27°30′ at 0004Z.
        (3) Pressure altitude — 18,900 feet.
        (4) Absolute altitude — 20,760 feet.

(NOTE: Expect jetstream influence on this leg.)

    h. Alter heading to Bermuda VOR (32°21′N — 064°42′W) from the 0000Z fix position (disregard the DR position).

    i. Determine the position at 0050Z based on the following data:

        (1) Polaris is observed with an HS of 31°38′ at 0046Z.
        (2) The upper limb of the Moon is observed with an HS of 03°42′ at 0050Z.
        (3) Bermuda (NWU) NDB indicates 059° MB to the station.

    j. Alter heading to Bermuda VOR (32°21′N — 064°42′W from the 0050Z fix position (disregard the DR position).

k. Complete the flight log from the 0050Z fix position to Bermuda VOR.

(NOTE: This is an academic problem; therefore, the wind velocity, direction, and atmospheric pressure may not be typical for the area and the time of year.)

5. Answer questions 6522 through 6535 by referring to the in-flight log and calculations.

**6522.** (Refer to instructions 1 through 5 for Part 2.) After departing over the Jacksonville VORTAC, what is the ETA at 30°42'N — 080°00'W?

1—2153Z.
2—2158Z.
3—2201Z.

**6523.** (Refer to instructions 1 through 5 for Part 2.) What is the position of the 2220Z fix?

1—31°12'N - 078°17'W.
2—31°09'N - 078°12'W.
3—31°17'N - 078°23'W.

**6524.** (Refer to instructions 1 through 5 for Part 2.) What is the true course from the 2220Z fix to the next position, 31°24'N — 075°00'W?

1—076°.
2—079°.
3—086°.

**6525.** (Refer to instructions 1 through 5 for Part 2.) What is the distance from the 2220Z fix to the next position, 31°24'N — 075°00'W?

1—159 NM.
2—169 NM.
3—175 NM.

**6526.** (Refer to instructions 1 through 5 for Part 2.) What is the position of the 2310Z fix?

1—31°33'N — 074°00'W.
2—31°46'N — 074°15'W.
3—31°58'N — 074°10'W.

**6527.** (Refer to instructions 1 through 5 for Part 2.) What is the distance between the 2220Z fix and the 2310Z fix?

1—211 NM.
2—217 NM.
3—222 NM.

**6528.** (Refer to instructions 1 through 5 for Part 2.) What is the magnetic heading between the 2310Z fix and 31°55'N — 070°00'W?

1—105°.
2—110°.
3—116°.

**6529.** (Refer to instructions 1 through 5 for Part 2.) What is the position of the 0000Z fix?

1—31°25'N — 069°32'W.
2—31°37'N — 069°40'W.
3—31°51'N — 069°42'W.

**6530.** (Refer to instructions 1 through 5 for Part 2.) What is the wind between the 2310Z fix and the 0000Z fix?

1—240°, 99 knots.
2—238°, 88 knots.
3—251°, 105 knots.

**6531.** (Refer to instructions 1 through 5 for Part 2.) What is the ETE between the 0000Z fix and Bermuda VOR 32°21'N — 064°42'W?

1—50 minutes.
2—55 minutes.
3—60 minutes.

**6532.** (Refer to instructions 1 through 5 for Part 2.) What is the position of the 0050Z fix?

1—31°31'N — 065°48'W.
2—31°48'N — 065°32'W.
3—31°37'N — 065°40'W.

**6533.** (Refer to instructions 1 through 5 for Part 2.) What is the groundspeed between the 0000Z fix and the 0050Z fix?

1—239 knots.
2—244 knots.
3—250 knots.

**6534.** (Refer to instructions 1 through 5 for Part 2.) What is the true heading between the 0050Z fix and the Bermuda VOR?

1—041°.
2—046°.
3—059°.

**6535.** (Refer to instructions 1 through 5 for Part 2.) What is the ETA at Bermuda VOR from the 0050Z fix?

1—0051Z.
2—0058Z.
3—0107Z.

### Flight Navigator Problem No. 2, Part 1 — Corpus Christi, Texas to Key West, Florida — Preflight Planning.

NOTE: Flight navigator applicants must provide their own plotters, dividers, computers, flight logs, and celestial forms. They may provide their own charts (GNC 9 or equivalent) or may use a copy of the charts in figures 154, 155, 156, 157, and Celestial Charts, figures 134 through 153. The test monitor will assure that the logs, forms, and charts are free of markings that would compromise the test. The monitor will also determine that the applicant's computer is acceptable.

Instructions for Preflight Planning Problem No. 2, Part 1:

1. Zero deviation will be used, i.e. compass heading and magnetic heading are the same.
2. Preflight a trip from Corpus Christi, Texas, VORTAC (27°54'N — 097°26'W) to Key West, Florida, VORTAC (24°35'N — 081°48'W) via direct route. Estimated time of departure (EDT) is 0900Z, September 20, 1978. The flight is planned for FL190 and 200 KTAS.
3. Winds aloft are forecast as follows:
   a. 27°30'N — 096°00'W — 310°, 25 knots.
   b. 27°30'N — 092°30'W — 290°, 30 knots.
   c. 26°00'N — 089°00'W — 270°, 35 knots.
   d. 25°30'N — 086°00'W — 260°, 35 knots.
   e. 25°00'N — 083°30'W — 250°, 40 knots.
4. Using the forecast winds given in item 3, develop a preflight log for the following legs:
   a. Corpus Christi VORTAC to 095°00'W.
   b. 095°00'W to 092°30'W.
   c. 092°30'W to 090°00'W.
   d. 090°00'W to 087°30'W.
   e. 087°30'W to 085°00'W.
   f. 085°00'W to Key West VORTAC.
5. Answer questions 6536 through 6539 by referring to the preflight log and calculations.

**6536.** (Refer to instructions 1 through 5 for Part 1.) What is the magnetic heading shown on the preflight log/form for the leg from 092°30'W to the 090°00'W en route to Key West VORTAC?

1—092°.
2—097°.
3—103°.

**6537.** (Refer to instructions 1 through 5 for Part 1.) What is the preflight groundspeed for the leg from 090°00'W to 087°30'W longitude en route to Key West?

1—225 knots.
2—229 knots.
3—234 knots.

**6538.** (Refer to instructions 1 through 5 for Part 1.) What is the preflight ETE from Corpus Christi VORTAC to Key West VORTAC?

1—3 hours 46 minutes.
2—3 hours 51 minutes.
3—3 hours 55 minutes.

**6539.** (Refer to instructions 1 through 5 for Part 1.) What is the preflight distance from Corpus Christi VORTAC to Key West VORTAC?

1—866 NM.
2—872 NM.
3—877 NM.

**Flight Navigator Problem No. 2, Part 2 — Corpus Christi, Texas to Key West, Florida — En Route.**

Instructions for En Route Planning Problem No. 2, Part 2:

1. See figures 134 through 153 for required celestial data and tables.
2. Alter headings, when instructed, at specified fix positions.
3. Navigation aids:
   a. Corpus Christi VORTAC — 27°54'N — 097°26'W.
   b. Brazos Santos NDB — 26°04'N — 097°09'W.
   c. Leeville VORTAC — 29°10'N — 090°06'W.
   d. Key West VORTAC — 24°35'N — 081°48'W.
   e. Sarasota VORTAC — 27°23'N — 082°33'W.
4. Complete the following scenario and answer the en route questions by referring to your preflight logs and calculations (Part 2).
   a. Depart over Corpus Christi VORTAC at 0930Z, level 19,000 feet, 200 KTAS, magnetic heading 091°.
      (1) Pressure altitude — 19,000 feet. (Assume altitude readings are taken over water.)
      (2) Absolute altitude — 20,470 feet. (Assume altitude readings are taken over water.)
   b. Compute an ETA for the 095°00'W position on the first leg using preflight winds.
   c. Determine the position at 1010Z based on the following data:
      (1) The upper limb of the Moon is observed with an HS of 70°34' at 1006Z.
      (2) Jupiter is observed with an HS of 27°29' at 1010Z.
      (3) Brazos Santiago NDB indicates a 235° magnetic bearing to the station.
      (4) Pressure altitude — 19,060 feet.
      (5) Absolute altitude — 20,370 feet.
   d. Alter heading to next position (26°32'N — 090°00'W) from the 1010Z fix position (disregard the DR position).
   e. Determine the position at 1100Z based on the following data:
      (1) Polaris is observed at 1100Z with an HS of 27°44'.
      (2) Pressure altitude — 19,060 feet.
      (3) Absolute altitude — 20,300 feet.
      (4) The RMI indicates the Leeville VOR 202 magnetic radial.
   f. Alter heading to the next position (26°00'N — 087°30'W) from the 1100Z fix position (disregard the DR position).
   g. Determine the position at 1150Z based on the following data:
      (1) Dubhe is observed with an HS of 28°45' at 1146Z.
      (2) Hamal is observed with an HS of 38°29' at 1150Z.
      (3) Sirius is observed with an HS of 45°36' at 1154Z.
      (4) Pressure altitude — 19,150 feet.
      (5) Absolute altitude — 20,400 feet.
   h. Alter heading to the next position (25°23'N — 085°00'W) from the 1150Z fix position (disregard the DR position).
   i. Determine the position at 1240Z based on the following data:
      (1) The upper limb of the Moon is observed with an HS of 31°03' at 1240Z.
      (2) The Sun is observed with an HS of 16°53' at 1244Z.
      (3) Pressure altitude — 19,150 feet.
      (4) Absolute altitude — 20,625 feet.
      (5) The RMI indicates the Sarasota VOR 229 magnetic radial.
   j. Alter heading to the Key West VORTAC from the 1240Z fix position (disregard the DR position).
   k. Complete the flight log from the 1240Z fix to the Key West VORTAC.

(NOTE: This is an academic problem; therefore, the wind velocity, direction, and atmospheric pressure may not be typical for the area and the time of year.)

5. Answer questions 6540 through 6553 by referring to the in-flight log and calculations.

**6540.** (Refer to instructions 1 through 5 for Part 2.) After departing over the Corpus Christi VORTAC, what is the ETA over 27°30'N — 095°00'W?

1—0956Z.
2—1000Z.
3—1006Z.

**6541.** (Refer to instructions 1 through 5 for Part 2.) What is the position of the 1010Z fix?

1—27°03'N — 094°36'W.
2—27°11'N — 094°55'W.
3—27°24'N — 094°29'W.

**6542.** (Refer to instructions 1 through 5 for Part 2.) What is the true course from the 1010Z fix to the next position, 26°32'N — 090°00'W?

1—091°.
2—094°.
3—098°.

**6543.** (Refer to instructions 1 through 5 for Part 2.) What is the distance from the 1010Z fix to the next position, 26°32'N — 090°00'W?

1—257 NM.
2—266 NM.
3—273 NM.

**6544.** (Refer to instructions 1 through 5 for Part 2.) What is the position of the 1100Z fix?

1—27°09'N — 091°03'W.
2—27°05'N — 091°17'W.
3—26°59'N — 091°09'W.

**6545.** (Refer to instructions 1 through 5 for Part 2.) What is the distance between the 1010Z fix and the 1100Z fix?

1—190 NM.
2—204 NM.
3—219 NM.

**6546.** (Refer to instructions 1 through 5 for Part 2.) What is the magnetic heading between the 1100Z fix and 26°00'N — 087°30'W?

1—095°.
2—098°.
3—102°.

**6547.** (Refer to instructions 1 through 5 for Part 2.) What is the position of the 1150Z fix?

1—26°15'N — 087°42'W.
2—26°27'N — 087°53'W.
3—26°33'N — 087°57'W.

**6548.** (Refer to instructions 1 through 5 for Part 2.) What is the wind between the 1100Z fix and the 1150Z fix?

1—252°, 30 knots.
2—260°, 22 knots.
3—262°, 25 knots.

**6549.** (Refer to instructions 1 through 5 for Part 2.) What is the ETE between the 1150 fix and the next position, 25°23'N — 085°00'W?

1—40 minutes.
2—45 minutes.
3—49 minutes.

**6550.** (Refer to instructions 1 through 5 for Part 2.) What is the position of the 1240Z fix?

1—25°34'N — 084°33'W.
2—25°45'N — 084°43'W.
3—25°52'N — 084°52'W.

**6551.** (Refer to instructions 1 through 5 for Part 2.) What is the groundspeed between the 1150Z fix and the 1240Z fix?

1—211 knots.
2—218 knots.
3—224 knots.

**6552.** (Refer to instructions 1 through 5 for Part 2.) What is the true heading between the 1240Z fix and the Key West VORTAC?

1—120°.
2—125°.
3—130°.

**6553.** (Refer to instructions 1 through 5 for Part 2.) What is the ETA to the Key West VORTAC from over the 1240Z fix?

1—1332Z.
2—1340Z.
3—1345Z.

# APPENDIX 1

## DEPARTMENT OF TRANSPORTATION

## FEDERAL AVIATION ADMINISTRATION

### SUBJECT MATTER KNOWLEDGE CODES

**To determine the knowledge area in which a particular question was incorrectly answered, compare the subject matter code(s) on AC Form 8080-2, Airmen Written Test Report, to the subject matter outline that follows. The total number of test items missed may differ from the number of subject matter codes shown on the AC Form 8080-2, since you may have missed more than one question in a certain subject matter code.**

| | |
|---|---|
| **FAR 1** | **Definitions and Abbreviations** |
| A01 | General Definitions |
| A02 | Abbreviations and Symbols |
| **FAR 23** | **Airworthiness Standards: Normal, Utility, and Acrobatic Category Aircraft** |
| A10 | General |
| **FAR 43** | **Maintenance, Preventive Maintenance, Rebuilding and Alteration** |
| A15 | General |
| A16 | Appendices |
| **FAR 61** | **Certification: Pilots and Flight Instructors** |
| A20 | General |
| A21 | Aircraft Ratings and Special Certificates |
| A22 | Student Pilots |
| A23 | Private Pilots |
| A24 | Commercial Pilots |
| A25 | Airline Transport Pilots |
| A26 | Flight Instructors |
| A27 | Appendix A: Practical Test Requirements for Airline Transport Pilot Certificates and Associated Class and Type Ratings |
| A28 | Appendix B: Practical Test Requirements for Rotorcraft Airline Transport Pilot Certificates with a Helicopter Class Rating and Associated Type Ratings |
| **FAR 63** | **Certification: Flight Crewmembers Other Than Pilots** |
| A30 | General |
| A31 | Flight Engineers |
| A32 | Flight Navigators |
| **FAR 65** | **Certification: Airmen Other Than Flight Crewmembers** |
| A40 | General |
| A41 | Aircraft Dispatchers |
| **FAR 67** | **Medical Standards and Certification** |
| A50 | General |
| A51 | Certification Procedures |
| **FAR 71** | **Designation of Federal Airways, Area Low Routes, Controlled Airspace, and Reporting Points** |
| A60 | General |
| A61 | Airport Radar Service Areas |
| **FAR 73** | **Special Use Airspace** |
| A70 | General |
| A71 | Restricted Areas |
| A72 | Prohibited Areas |
| **FAR 75** | **Establishment of Jet Routes and Area High Routes** |
| A80 | General |
| **FAR 77** | **Objects Affecting Navigable Airspace** |
| A90 | General |
| **FAR 91** | **General Operating Rules** |
| B01 | General |
| B02 | Flight Rules |
| B03 | Maintenance, Preventive Maintenance, and Alterations |
| B04 | Large and Turbine-Powered Multiengine Airplanes |
| B05 | Operating Noise Limits |
| B06 | Appendix A: Category II Operations Manual, Instruments, Equipment, and Maintenance |
| **FAR 103** | **Ultralight Vehicles** |
| C01 | General |
| C02 | Operating Rules |
| **FAR 108** | **Airplane Operator Security** |
| C10 | General |
| **FAR 121** | **Certification and Operations: Domestic, Flag and Supplemental Air Carriers and Commercial Operators of Large Aircraft** |
| D01 | General |
| D02 | Certification Rules for Domestic and Flag Air Carriers |
| D03 | Certification Rules for Supplemental Air Carriers and Commercial Operators |

## Appendix 1

| | |
|---|---|
| D04 | Rules Governing all Certificate Holders Under This Part |
| D05 | Approval of Routes: Domestic and Flag Air Carriers |
| D06 | Approval of Areas and Routes for Supplemental Air Carriers and Commercial Operators |
| D07 | Manual Requirements |
| D08 | Aircraft Requirements |
| D09 | Airplane Performance Operating Limitations |
| D10 | Special Airworthiness Requirements |
| D11 | Instrument and Equipment Requirements |
| D12 | Maintenance, Preventive Maintenance, and Alterations |
| D13 | Airman and Crewmember Requirements |
| D14 | Training Program |
| D15 | Crewmember Qualifications |
| D16 | Aircraft Dispatcher Qualifications and Duty Time Limitations: Domestic and Flag Air Carriers |
| D17 | Flight Time Limitations and Rest Requirements: Domestic Air Carriers |
| D18 | Flight Time Limitations: Flag Air Carriers |
| D19 | Flight Time Limitations: Supplemental Air Carriers and Commercial Operators |
| D20 | Flight Operations |
| D21 | Dispatching and Flight Release Rules |
| D22 | Records and Reports |
| D23 | Crewmember Certificate: International |
| D24 | Special Federal Aviation Regulation SFAR No. 14 |

### FAR 125 Certification and Operations: Airplanes Having a Seating Capacity of 20 or More Passengers or a Maximum Payload Capacity of 6,000 Pounds or More

| | |
|---|---|
| D30 | General |
| D31 | Certification Rules and Miscellaneous Requirements |
| D32 | Manual Requirements |
| D33 | Airplane Requirements |
| D34 | Special Airworthiness Requirements |
| D35 | Instrument and Equipment Requirements |
| D36 | Maintenance |
| D37 | Airman and Crewmember Requirements |
| D38 | Flight Crewmember Requirements |
| D39 | Flight Operations |
| D40 | Flight Release Rules |
| D41 | Records and Reports |

### FAR 135 Air Taxi Operators and Commercial Operators

| | |
|---|---|
| E01 | General |
| E02 | Flight Operations |
| E03 | Aircraft and Equipment |
| E04 | VFR/IFR Operating Limitations and Weather Requirements |
| E05 | Flight Crewmember Requirements |
| E06 | Flight Crewmember Flight Time Limitations and Rest Requirements |
| E07 | Crewmember Testing Requirements |
| E08 | Training |
| E09 | Airplane Performance Operating Limitations |
| E10 | Maintenance, Preventive Maintenance, and Alterations |
| E11 | Appendix A: Additional Airworthiness Standards for 10 or More Passenger Airplanes |
| E12 | Special Federal Aviation Regulations SFAR No. 36 |
| E13 | Special Federal Aviation Regulations SFAR No. 38 |

### FAR 143 Certification: Ground Instructors

| | |
|---|---|
| F01 | General |

### US HMR 172 Hazardous Materials Table

| | |
|---|---|
| F02 | General |

### US HMR 175 Materials Transportation Bureau Hazardous Materials Regulations (HMR)

| | |
|---|---|
| G01 | General Information and Regulations |
| G02 | Loading, Unloading, and Handling |
| G03 | Specific Regulation Applicable According to Classification of Material |

### NTSB 830 Rules Pertaining to the Notification and Reporting of Aircraft Accidents or Incidents and Overdue Aircraft, and Preservation of Aircraft Wreckage, Mail, Cargo, and Records

| | |
|---|---|
| G10 | General |
| G11 | Initial Notification of Aircraft Accidents, Incidents, and Overdue Aircraft |
| G12 | Preservation of Aircraft Wreckage, Mail, Cargo, and Records |
| G13 | Reporting of Aircraft Accidents, Incidents, and Overdue Aircraft |

### AC 61-23 Pilot's Handbook of Aeronautical Knowledge

| | |
|---|---|
| H01 | Principles of Flight |
| H02 | Airplanes and Engines |
| H03 | Flight Instruments |
| H04 | Airplane Performance |
| H05 | Weather |
| H06 | Basic Calculations Using Navigational Computers or Electronic Calculators |
| H07 | Navigation |
| H08 | Flight Information Publications |
| H09 | Appendix 1: Obtaining FAA Publications |

### AC 91-23 Pilot's Weight and Balance Handbook

| | |
|---|---|
| H10 | Weight and Balance Control |
| H11 | Terms and Definitions |
| H12 | Empty Weight Center of Gravity |
| H13 | Index and Graphic Limits |
| H14 | Change of Weight |
| H15 | Control of Loading — General Aviation |
| H16 | Control of Loading — Large Aircraft |

| **AC 60-14** | **Aviation Instructor's Handbook** |
|---|---|
| H20 | The Learning Process |
| H21 | Human Behavior |
| H22 | Effective Communication |
| H23 | The Teaching Process |
| H24 | Teaching Methods |
| H25 | The Instructor as a Critic |
| H26 | Evaluation |
| H27 | Instructional Aids |
| H30 | Flight Instructor Characteristics and Responsibilities |
| H31 | Techniques of Flight Instruction |
| H32 | Planning Instructional Activity |
| H40 | Aircraft Maintenance Instructor Characteristics and Responsibilities |
| H41 | Integrated Job Training |
| H42 | Planning Aircraft Maintenance Instructional Activities |
| H43 | Appendix |

| **AC 61-21** | **Flight Training Handbook** |
|---|---|
| H50 | Introduction to Flight Training |
| H51 | Introduction to Airplanes and Engines |
| H52 | Introduction to the Basics of Flight |
| H53 | The Effect and Use of Controls |
| H54 | Ground Operations |
| H55 | Basic Flight Maneuvers |
| H56 | Airport Traffic Patterns and Operations |
| H57 | Takeoffs and Departure Climbs |
| H58 | Landing Approaches and Landings |
| H59 | Faulty Approaches and Landings |
| H60 | Proficiency Flight Maneuvers |
| H61 | Cross-Country Flying |
| H62 | Emergency Flight by Reference to Instruments |
| H63 | Night Flying |
| H64 | Seaplane Operations |
| H65 | Transition to Other Airplanes |
| H66 | Principles of Flight and Performance Characteristics |

| **AC 61-13** | **Basic Helicopter Handbook** |
|---|---|
| H70 | General Aerodynamics |
| H71 | Aerodynamics of Flight |
| H72 | Loads and Load Factors |
| H73 | Function of the Controls |
| H74 | Other Helicopter Components and Their Functions |
| H75 | Introduction to the Helicopter Flight Manual |
| H76 | Weight and Balance |
| H77 | Helicopter Performance |
| H78 | Some Hazards of Helicopter Flight |
| H79 | Precautionary Measures and Critical Conditions |
| H80 | Helicopter Flight Maneuvers |
| H81 | Confined Area, Pinnacle, and Ridgeline Operations |
| H82 | Glossary |

**Gyroplane Flight Training Manual**

|  |  |
|---|---|
| H90 | Gyroplane Systems |
| H91 | Gyroplane Terms |
| H92 | Use of Flight Controls (Gyroplane) |
| H93 | Fundamental Maneuvers of Flight (Gyroplane) |
| H94 | Basic Flight Maneuvers (Gyroplane) |

| **AC 61-27** | **Instrument Flying Handbook** |
|---|---|
| I01 | Training Considerations |
| I02 | Instrument Flying: Coping with Illusions in Flight |
| I03 | Aerodynamic Factors Related to Instrument Flying |
| I04 | Basic Flight Instruments |
| I05 | Attitude Instrument Flying — Airplanes |
| I06 | Attitude Instrument Flying — Helicopters |
| I07 | Electronic Aids to Instrument Flying |
| I08 | Using the Navigation Instruments |
| I09 | Radio Communications Facilities and Equipment |
| I10 | The Federal Airways System and Controlled Airspace |
| I11 | Air Traffic Control |
| I12 | ATC Operations and Procedures |
| I13 | Flight Planning |
| I14 | Appendix: Instrument Instructor Lesson Guide — Airplanes |
| I15 | Segment of En Route Low Altitude Chart |

| **AC 00-6** | **Aviation Weather** |
|---|---|
| I20 | The Earth's Atmosphere |
| I21 | Temperature |
| I22 | Atmospheric Pressure and Altimetry |
| I23 | Wind |
| I24 | Moisture, Cloud Formation, and Precipitation |
| I25 | Stable and Unstable Air |
| I26 | Clouds |
| I27 | Air Masses and Fronts |
| I28 | Turbulence |
| I29 | Icing |
| I30 | Thunderstorms |
| I31 | Common IFR Producers |
| I32 | High Altitude Weather |
| I33 | Arctic Weather |
| I34 | Tropical Weather |
| I35 | Soaring Weather |
| I36 | Glossary of Weather Terms |

| **AC 00-45** | **Aviation Weather Services** |
|---|---|
| I40 | The Aviation Weather Service Program |
| I41 | Surface Aviation Weather Reports |
| I42 | Pilot and Radar Reports and Satellite Pictures |
| I43 | Aviation Weather Forecasts |
| I44 | Surface Analysis Chart |
| I45 | Weather Depiction Chart |
| I46 | Radar Summary Chart |
| I47 | Significant Weather Prognostics |
| I48 | Winds and Temperatures Aloft |

| | |
|---|---|
| I49 | Composite Moisture Stability Chart |
| I50 | Severe Weather Outlook Chart |
| I51 | Constant Pressure Charts |
| I52 | Tropopause Data Chart |
| I53 | Tables and Conversion Graphs |

## AIM Airman's Information Manual

| | |
|---|---|
| J01 | Air Navigation Radio Aids |
| J02 | Radar Services and Procedures |
| J03 | Airport Lighting Aids |
| J04 | Air Navigation and Obstruction Lighting |
| J05 | Airport Marking Aids |
| J06 | Airspace — General |
| J07 | Uncontrolled Airspace |
| J08 | Controlled Airspace |
| J09 | Special Use Airspace |
| J10 | Other Airspace Areas |
| J11 | Service Available to Pilots |
| J12 | Radio Communications Phraseology and Techniques |
| J13 | Airport Operations |
| J14 | ATC Clearance/Separations |
| J15 | Preflight |
| J16 | Departure Procedures |
| J17 | En Route Procedures |
| J18 | Arrival Procedures |
| J19 | Pilot/Controller Roles and Responsibilities |
| J20 | National Security and Interception Procedures |
| J21 | Emergency Procedures — General |
| J22 | Emergency Services Available to Pilots |
| J23 | Distress and Urgency Procedures |
| J24 | Two-Way Radio Communications Failure |
| J25 | Meteorology |
| J26 | Altimeter Setting Procedures |
| J27 | Wake Turbulence |
| J28 | Bird Hazards, and Flight Over National Refuges, Parks, and Forests |
| J29 | Potential Flight Hazards |
| J30 | Safety, Accident, and Hazard Reports |
| J31 | Fitness for Flight |
| J32 | Type of Charts Available |
| J33 | Pilot Controller Glossary |
| J34 | Airport/Facility Directory |
| J35 | En Route Low Altitude Chart |
| J36 | En Route High Altitude Chart |
| J37 | Sectional Chart |
| J38 | WAC Chart |
| J39 | Terminal Area Chart |
| J40 | Standard Instrument Departure (SID) Chart |
| J41 | Standard Terminal Arrival (STAR) Chart |
| J42 | Instrument Approach Procedures |
| J43 | Helicopter Route Chart |

## AC 67-2 Medical Handbook for Pilots

| | |
|---|---|
| J50 | The Flyer's Environment |
| J51 | The Pressure is On |
| J52 | Hypoxia |
| J53 | Hyperventilation |
| J54 | The Gas in the Body |
| J55 | The Ears |
| J56 | Alcohol |
| J57 | Drugs and Flying |
| J58 | Carbon Monoxide |
| J59 | Vision |
| J60 | Night Flight |
| J61 | Cockpit Lighting |
| J62 | Disorientation (Vertigo) |
| J63 | Motion Sickness |
| J64 | Fatigue |
| J65 | Noise |
| J66 | Age |
| J67 | Some Psychological Aspects of Flying |
| J68 | The Flying Passenger |

## ADDITIONAL ADVISORY CIRCULARS

| | |
|---|---|
| K01 | AC 00-24, Thunderstorms |
| K02 | AC 00-30, Rules of Thumb for Avoiding or Minimizing Encounters with Clear Air Turbulence |
| K03 | AC 00-34, Aircraft Ground Handling and Servicing |
| K04 | AC 00-50, Low Level Wind Shear |
| K10 | AC 20-5, Plane Sense |
| K11 | AC 20-29, Use of Aircraft Fuel Anti-Icing Additives |
| K12 | AC 20-32, Carbon Monoxide (CO) Contamination in Aircraft — Detection and Prevention |
| K13 | AC 20-43, Aircraft Fuel Control |
| K14 | AC 20-64, Maintenance Inspection Notes for Lockheed L-188 Series Aircraft |
| K15 | AC 20-76, Maintenance Inspection Notes for Boeing B-707/720 Series Aircraft |
| K16 | AC 20-78, Maintenance Inspection Notes for McDonnell Douglas DC-8 Series Aircraft |
| K17 | AC 20-84, Maintenance Inspection Notes for Boeing B-727 Series Aircraft |
| K18 | AC 20-99, Antiskid and Associated Systems |
| K19 | AC 20-101, Omega and Omega/VLF Navigation Systems Approvals for Use in the Conterminous United States and Alaska |
| K20 | AC 20-103, Aircraft Engine Crankshaft Failure |
| K21 | AC 20-106, Aircraft Inspection for the General Aviation Aircraft Owner |
| K22 | AC 20-113, Pilot Precautions and Procedures to be Taken in Preventing Aircraft Reciprocating Engine Induction System and Fuel System Icing Problems |
| K23 | AC 20-121, Airworthiness Approval of Airborne Loran-C Systems for Use in the U.S. National Airspace System |
| K24 | AC 20-125, Water in Aviation Fuels |
| K30 | AC 23.679-1, Control System Locks |
| K31 | AC 23.1521-1, Approval of Automobile Gasoline (Autogas) in Lieu of Aviation Gasoline (Avgas) in Small Airplanes with Reciprocating Engines |
| K40 | AC 25-4, Inertial Navigation Systems (INS) |
| K41 | AC 25.253-1, High-Speed Characteristics |
| K50 | AC 29-2, Certification of Transportation Category Rotorcraft |

| | |
|---|---|
| K60 | AC 33.65-1, Surge and Stall Characteristics of Aircraft Turbine Engines |
| K70 | AC 43-9, Maintenance Records |
| K71 | AC 43-12, Preventive Maintenance |
| K80 | AC 60-4, Pilot's Spatial Disorientation |
| K81 | AC 60-6, Airplane Flight Manuals (AFM), Approved Manual Materials, Markings, and Placards — Airplanes |
| K90 | AC 60-12, Availability of Industry-Developed Guidelines for the Conduct of the Biennial Flight Review |
| L01 | AC 61-9, Pilot Transition Courses for Complex Single-Engine and Light, Twin-Engine Airplanes |
| L02 | AC 61-10, Private and Commercial Pilots Refresher Courses |
| L03 | AC 61-12, Student Pilot Guide |
| L04 | AC 61-47, Use of Approach Slope Indicators for Pilot Training |
| L05 | AC 61-65, Certification: Pilot and Flight Instructors |
| L06 | AC 61-66, Annual Pilot In Command Proficiency Checks |
| L07 | AC 61-67, Hazards Associated with Spins in Airplanes Prohibited from Intentional Spinning |
| L08 | AC 61-84, Role of Preflight Preparation |
| L09 | AC 61-89, Pilot Certificates: Aircraft Type Ratings |
| L10 | AC 61-92, Use of Distractions During Pilot Certification Flight Tests |
| L11 | AC 61-94, Pilot Transition Course for Self-Launching or Powered Sailplanes (Motor gliders) |
| L20 | AC 67-1, Medical Information for Air Ambulance Operators |
| L30 | AC 90-23, Aircraft Wake Turbulence |
| L31 | AC 90-34, Accidents Resulting from Wheelbarrowing in Tricycle-Gear Equipped Aircraft |
| L32 | AC 90-42, Traffic Advisory Practices at Nontower Airports |
| L33 | AC 90-45, Approval of Area Navigation Systems for Use in the U.S. National Airspace System |
| L34 | AC 90-48, Pilots' Role in Collision Avoidance |
| L35 | AC 90-58, VOR Course Errors Resulting from 50 kHz Channel Mis-Selection |
| L36 | AC 90-66, Recommended Standard Traffic Patterns for Airplane Operations at Uncontrolled Airports |
| L37 | AC 90-67, Light Signals from the Control Tower for Ground Vehicles, Equipment, and Personnel |
| L38 | AC 90-79, Recommended Practices and Procedures for the Use of Electronic Long Range Navigation Equipment |
| L39 | AC 90-82, Random Area Navigation Routes |
| L40 | AC 90-83, Terminal Control Areas (TCA) |
| L41 | AC 90-85, Severe Weather Avoidance Plan (SWAP) |
| L42 | AC 90-87, Helicopter Dynamic Rollover |
| L43 | AC 90-88, Airport Radar Service Area (ARSA) |
| L50 | AC 91-6, Water, Slush, and Snow on the Runway |
| L51 | AC 91-8, Use of Oxygen by Aviation Pilots/Passengers |
| L52 | AC 91-13, Cold Weather Operation of Aircraft |
| L53 | AC 91-14, Altimeter Setting Sources |
| L54 | AC 91-16, Category II Operations — General Aviation Airplanes |
| L55 | AC 91-32, Safety In and Around Helicopters |
| L56 | AC 91-42, Hazards of Rotating Propeller and Helicopter Rotor Blades |
| L57 | AC 91-43, Unreliable Airspeed Indications |
| L58 | AC 91-44, Operational and Maintenance Practices for Emergency Locator Transmitters and Receivers |
| L59 | AC 91-46, Gyroscopic Instruments — Good Operating Practices |
| L60 | AC 91-49, General Aviation Procedures for Flight in North Atlantic Minimum Navigation Performance Specifications Airspace |
| L61 | AC 91-50, Importance of Transponder Operation and Altitude Reporting |
| L62 | AC 91-51, Airplane Deice and Anti-Ice Systems |
| L63 | AC 91-53, Noise Abatement Departure Profile |
| L64 | AC 91-55, Reduction of Electrical System Failures Following Aircraft Engine Starting |
| L65 | AC 91-58, Use of Pyrotechnic Visual Distress Signaling Devices in Aviation |
| L66 | AC 91-64, Use of Remote Altimeter Settings Instrument Approach Procedures |
| L67 | AC 91-83, Canceling or Closing Flight Plans |
| L70 | AC 97-1, Runway Visual Range (RVR) |
| L80 | AC 103-4, Hazard Associated with Sublimation of Solid Carbon Dioxide (Dry Ice) Aboard Aircraft |
| L81 | AC 103-6, Ultralight Vehicle Operations Airports, ATC, and Weather |
| L82 | AC 103-7, The Ultralight Vehicle |
| M01 | AC 120-12, Private Carriage Versus Common Carriage of Persons or Property |
| M02 | AC 120-27, Aircraft Weight and Balance Control |
| M03 | AC 120-29, Criteria for Approving Category I and Category II Landing Minima for FAR 121 Operators |
| M04 | AC 120-32, Air Transportation of Handicapped Persons |
| M10 | AC 121-6, Portable Battery-Powered Megaphones |
| M11 | AC 121-24, Passenger Safety Information Briefing and Briefing Cards |
| M12 | AC 121-25, Additional Weather Information: Domestic and Flag Air Carriers |
| M13 | AC 121-195, Alternate Operational Landing Distances for Wet Runways; Turbojet Powered Transport Category Airplanes |

| | |
|---|---|
| M20 | AC 125-1, Operations of Large Airplanes Subject to Federal Aviation Regulations Part 125 |
| M30 | AC 135-3, Air Taxi Operators and Commercial Operators |
| M31 | AC 135-9, FAR Part 135 Icing Limitations |
| M32 | AC 135-12, Passenger Information, FAR Part 135: Passenger Safety Information Briefing and Briefing Cards |
| M40 | AC 150/5345-28, Precision Approach Path Indicator (PAPI) Systems |
| M50 | AC 20-34, Prevention of Retractable Landing Gear Failures |
| M51 | AC 20-117,Hazards Following Ground Deicing and Ground Operations in Conditions Conducive to Aircraft Icing |

### American Soaring Handbook — Gliders

| | |
|---|---|
| N01 | A History of American Soaring |
| N02 | Training |
| N03 | Ground Launch |
| N04 | Airplane Tow |
| N05 | Meteorology |
| N06 | Cross-Country and Wave Soaring |
| N07 | Instruments and Oxygen |
| N08 | Radio, Rope, and Wire |
| N09 | Aerodynamics |
| N10 | Maintenance and Repair |

### Soaring Flight Manual — Gliders

| | |
|---|---|
| N20 | Sailplane Aerodynamics |
| N21 | Performance Considerations |
| N22 | Flight Instruments |
| N23 | Weather for Soaring |
| N24 | Medical Factors |
| N25 | Flight Publications and Airspace |
| N26 | Aeronautical Charts and Navigation |
| N27 | Computations for Soaring |
| N28 | Personal Equipment |
| N29 | Preflight and Ground Operations |
| N30 | Aerotow Launch Procedures |
| N31 | Ground Launch Procedures |
| N32 | Basic Flight Maneuvers and Traffic Patterns |
| N33 | Soaring Techniques |
| N34 | Cross-Country Soaring |

### Taming The Gentle Giant — Balloons

| | |
|---|---|
| O01 | Design and Construction of Balloons |
| O02 | Fuel Source and Supply |
| O03 | Weight and Temperature |
| O04 | Flight Instruments |
| O05 | Balloon Flight Tips |
| O06 | Glossary |

### Balloon Federation Of America — Flight Instructor Manual

| | |
|---|---|
| O10 | Flight Instruction Aids |
| O11 | Human Behavior and Pilot Proficiency |
| O12 | The Flight Check and the Designated Examiner |

### The Balloon Federation Of America Handbook — Propane Systems

| | |
|---|---|
| O20 | Propane Glossary |
| O21 | Chemical and Physical Systems |
| O22 | Cylinders |
| O23 | Lines and Fittings |
| O24 | Valves |
| O25 | Regulators |
| O26 | Burners |
| O27 | Propane Systems — Schematics |
| O28 | Propane References |

### The Balloon Federation Of America Handbook — Avoiding Powerline Accidents

| | |
|---|---|
| O30 | Excerpts |

### Balloon Flight Manual

| | |
|---|---|
| O40 | Excerpts |

### Airship Operations Manual

| | |
|---|---|
| P01 | Buoyancy |
| P02 | Aerodynamics |
| P03 | Free Ballooning |
| P04 | Aerostatics |
| P05 | Envelope |
| P06 | Car |
| P07 | Powerplant |
| P08 | Airship Ground Handling |
| P09 | Operating Instructions |
| P10 | History |

### International Flight Information Manual

| | |
|---|---|
| Q01 | Passport and Visa |
| Q02 | International NOTAM Availability and Distribution |
| Q03 | National Security |
| Q04 | International Interception Procedures |
| Q05 | Intercept Pattern for Identification of Transport Aircraft |
| Q06 | Flight Planning Notes |
| Q07 | North Atlantic Minimum Navigation Requirements |
| Q08 | North American Routes for North Atlantic Traffic |
| Q09 | U.S. Aeronautical Telecommunications Services |
| Q10 | Charts and Publications for Flights Outside the U.S. |
| Q11 | Oceanic Long-Range Navigation Information |

### Aerodynamics For Naval Aviators, NAVWEPS 00-80T-80

| | |
|---|---|
| R01 | Wing and Airfoil Forces |
| R02 | Planform Effects and Airplane Drag |
| R10 | Required Thrust and Power |
| R11 | Available Thrust and Power |
| R12 | Items of Airplane Performance |
| R21 | General Concepts and Supersonic Flow Patterns |
| R22 | Configuration Effects |

| | |
|---|---|
| R31 | Definitions |
| R32 | Longitudinal Stability and Control |
| R33 | Directional Stability and Control |
| R34 | Lateral Stability and Control |
| R35 | Miscellaneous Stability Problems |
| R40 | General Definitions and Structural Requirements |
| R41 | Aircraft Loads and Operating Limitations |
| R50 | Application of Aerodynamics to Specific Problems of Flying |

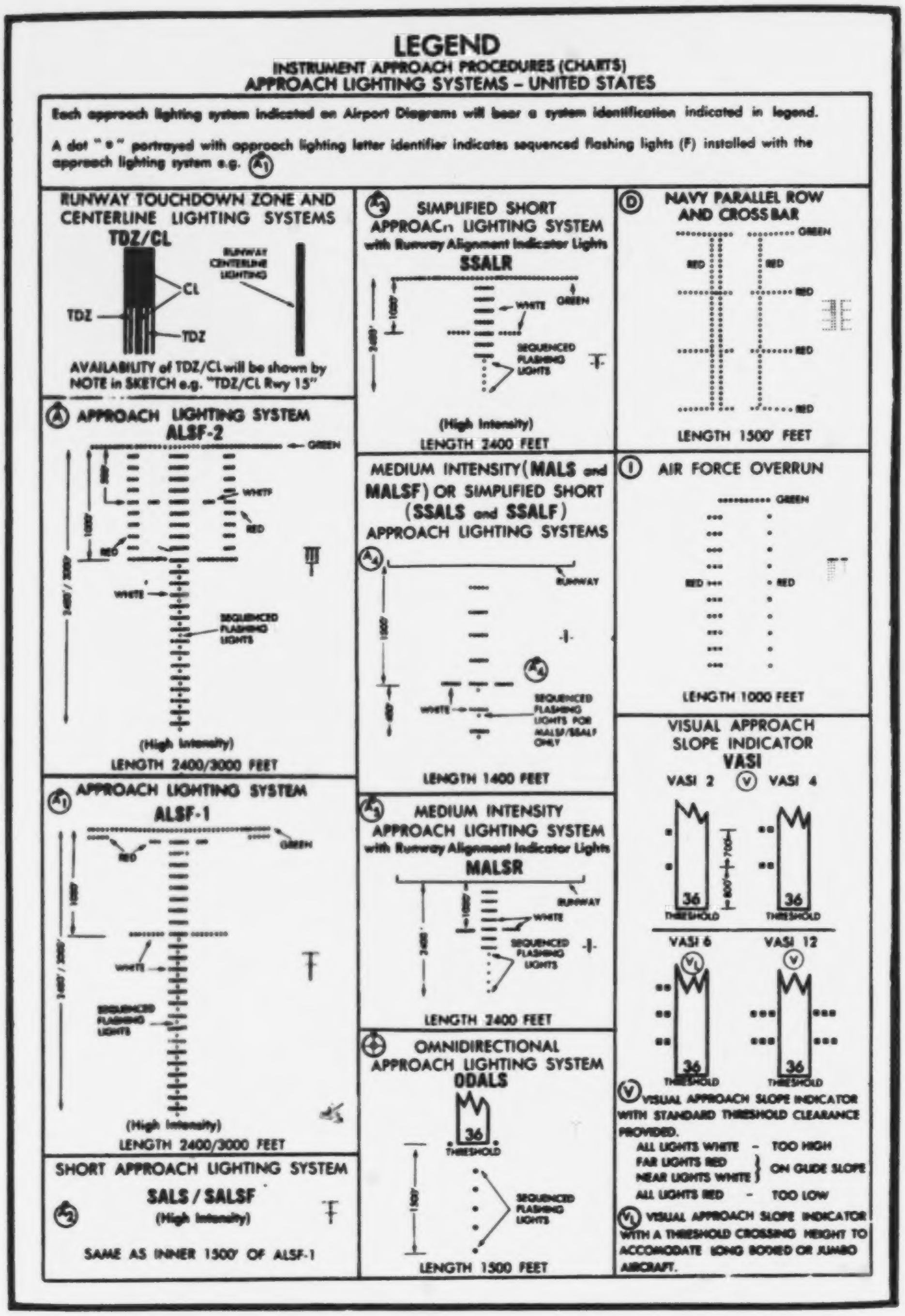
**Transport Airplane Operations Manual**

| | |
|---|---|
| S01 | Reserved |
| T01 | Reserved |
| U01 | Reserved |
| V01 | Reserved |
| W01 | Reserved |
| X01 | Reserved |
| Y01 | Reserved |
| Z01 | Visual Flight Rules Chart Users Guide |
| Z02 | Pilot's Guide to IVRS |

**NOTE:** Most of the references and study materials listed in these subject matter knowledge codes are available through government outlets such as U.S. Government Printing Office bookstores. AC 00-2, Advisory Circular Checklist, transmits the status of all FAA AC's (advisory circulars), as well as FAA internal publications and miscellaneous flight information such as AIM, Airport/Facility Directory, written test question books, practical test standards, and other material directly related to a certificate or rating. To obtain a free copy of the AC 00-2, send your request to:

U.S. Department of Transportation
Utilization and Storage Section, M-443.2
Washington, DC 20590

# APPENDIX 2



LEGEND

INSTRUMENT APPROACH PROCEDURES (CHARTS)
APPROACH LIGHTING SYSTEMS – UNITED STATES

Each approach lighting system indicated on Airport Diagrams will bear a system identification indicated in legend.

A dot "•" portrayed with approach lighting letter identifier indicates sequenced flashing lights (F) installed with the approach lighting system e.g. (A1)

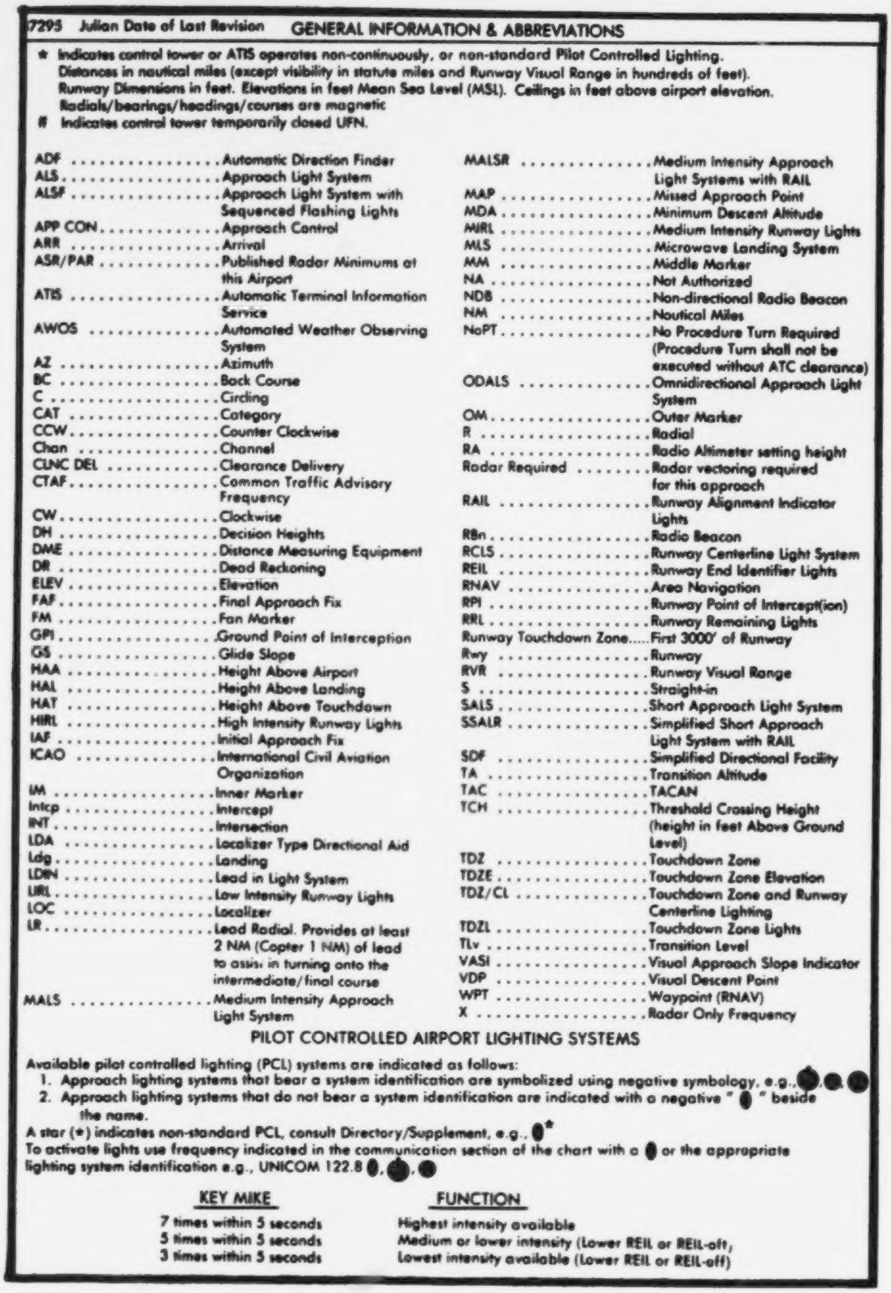
RUNWAY TOUCHDOWN ZONE AND CENTERLINE LIGHTING SYSTEMS
TDZ/CL
RUNWAY CENTERLINE LIGHTING
CL
TDZ
TDZ
AVAILABILITY of TDZ/CL will be shown by NOTE in SKETCH e.g. "TDZ/CL Rwy 15"
A3
SIMPLIFIED SHORT APPROACH LIGHTING SYSTEM with Runway Alignment Indicator Lights
SSALR
1000'
2400'
WHITE
GREEN
SEQUENCED FLASHING LIGHTS
(High Intensity)
LENGTH 2400 FEET
D
NAVY PARALLEL ROW AND CROSS BAR
GREEN
RED
RED
RED
RED
RED
LENGTH 1500' FEET
A
APPROACH LIGHTING SYSTEM
ALSF-2
GREEN
WHITE
RED
RED
1000'
2400' / 3000'
WHITE
SEQUENCED FLASHING LIGHTS
(High Intensity)
LENGTH 2400/3000 FEET
MEDIUM INTENSITY (MALS and MALSF) OR SIMPLIFIED SHORT (SSALS and SSALF) APPROACH LIGHTING SYSTEMS
A4
RUNWAY
1000'
400'
A4
WHITE
SEQUENCED FLASHING LIGHTS FOR MALSF/SSALF ONLY
LENGTH 1400 FEET
I
AIR FORCE OVERRUN
GREEN
RED
RED
LENGTH 1000 FEET
A1
APPROACH LIGHTING SYSTEM
ALSF-1
RED
GREEN
1000'
2400' / 3000'
WHITE
SEQUENCED FLASHING LIGHTS
(High Intensity)
LENGTH 2400/3000 FEET
A5
MEDIUM INTENSITY APPROACH LIGHTING SYSTEM with Runway Alignment Indicator Lights
MALSR
RUNWAY
1000'
2400'
WHITE
SEQUENCED FLASHING LIGHTS
LENGTH 2400 FEET
VISUAL APPROACH SLOPE INDICATOR
VASI
VASI 2
V
VASI 4
700'
800'
36
THRESHOLD
36
THRESHOLD
VASI 6
VL
VASI 12
V
36
THRESHOLD
36
THRESHOLD
SHORT APPROACH LIGHTING SYSTEM
SALS / SALSF
A2
(High Intensity)
SAME AS INNER 1500' OF ALSF-1
OMNIDIRECTIONAL APPROACH LIGHTING SYSTEM
ODALS
36
THRESHOLD
1500'
SEQUENCED FLASHING LIGHTS
LENGTH 1500 FEET

(V) VISUAL APPROACH SLOPE INDICATOR WITH STANDARD THRESHOLD CLEARANCE PROVIDED.

ALL LIGHTS WHITE – TOO HIGH
FAR LIGHTS RED
NEAR LIGHTS WHITE } ON GLIDE SLOPE
ALL LIGHTS RED – TOO LOW

(VL) VISUAL APPROACH SLOPE INDICATOR WITH A THRESHOLD CROSSING HEIGHT TO ACCOMODATE LONG BODIED OR JUMBO AIRCRAFT.

LEGEND 1.—Instrument Approach Procedures Chart (Approach Lighting Systems).



7295 Julian Date of Last Revision

## GENERAL INFORMATION & ABBREVIATIONS

* Indicates control tower or ATIS operates non-continuously, or non-standard Pilot Controlled Lighting.
Distances in nautical miles (except visibility in statute miles and Runway Visual Range in hundreds of feet).
Runway Dimensions in feet. Elevations in feet Mean Sea Level (MSL). Ceilings in feet above airport elevation.
Radials/bearings/headings/courses are magnetic
# Indicates control tower temporarily closed UFN.

| | |
|---|---|
| ADF | Automatic Direction Finder |
| ALS | Approach Light System |
| ALSF | Approach Light System with Sequenced Flashing Lights |
| APP CON | Approach Control |
| ARR | Arrival |
| ASR/PAR | Published Radar Minimums at this Airport |
| ATIS | Automatic Terminal Information Service |
| AWOS | Automated Weather Observing System |
| AZ | Azimuth |
| BC | Back Course |
| C | Circling |
| CAT | Category |
| CCW | Counter Clockwise |
| Chan | Channel |
| CLNC DEL | Clearance Delivery |
| CTAF | Common Traffic Advisory Frequency |
| CW | Clockwise |
| DH | Decision Heights |
| DME | Distance Measuring Equipment |
| DR | Dead Reckoning |
| ELEV | Elevation |
| FAF | Final Approach Fix |
| FM | Fan Marker |
| GPI | Ground Point of Interception |
| GS | Glide Slope |
| HAA | Height Above Airport |
| HAL | Height Above Landing |
| HAT | Height Above Touchdown |
| HIRL | High Intensity Runway Lights |
| IAF | Initial Approach Fix |
| ICAO | International Civil Aviation Organization |
| IM | Inner Marker |
| Intcp | Intercept |
| INT | Intersection |
| LDA | Localizer Type Directional Aid |
| Ldg | Landing |
| LDIN | Lead in Light System |
| LIRL | Low Intensity Runway Lights |
| LOC | Localizer |
| LR | Lead Radial. Provides at least 2 NM (Copter 1 NM) of lead to assist in turning onto the intermediate/final course |
| MALS | Medium Intensity Approach Light System |
| MALSR | Medium Intensity Approach Light Systems with RAIL |
| MAP | Missed Approach Point |
| MDA | Minimum Descent Altitude |
| MIRL | Medium Intensity Runway Lights |
| MLS | Microwave Landing System |
| MM | Middle Marker |
| NA | Not Authorized |
| NDB | Non-directional Radio Beacon |
| NM | Nautical Miles |
| NoPT | No Procedure Turn Required (Procedure Turn shall not be executed without ATC clearance) |
| ODALS | Omnidirectional Approach Light System |
| OM | Outer Marker |
| R | Radial |
| RA | Radio Altimeter setting height |
| Radar Required | Radar vectoring required for this approach |
| RAIL | Runway Alignment Indicator Lights |
| RBn | Radio Beacon |
| RCLS | Runway Centerline Light System |
| REIL | Runway End Identifier Lights |
| RNAV | Area Navigation |
| RPI | Runway Point of Intercept(ion) |
| RRL | Runway Remaining Lights |
| Runway Touchdown Zone | First 3000' of Runway |
| Rwy | Runway |
| RVR | Runway Visual Range |
| S | Straight-in |
| SALS | Short Approach Light System |
| SSALR | Simplified Short Approach Light System with RAIL |
| SDF | Simplified Directional Facility |
| TA | Transition Altitude |
| TAC | TACAN |
| TCH | Threshold Crossing Height (height in feet Above Ground Level) |
| TDZ | Touchdown Zone |
| TDZE | Touchdown Zone Elevation |
| TDZ/CL | Touchdown Zone and Runway Centerline Lighting |
| TDZL | Touchdown Zone Lights |
| TLv | Transition Level |
| VASI | Visual Approach Slope Indicator |
| VDP | Visual Descent Point |
| WPT | Waypoint (RNAV) |
| X | Radar Only Frequency |

### PILOT CONTROLLED AIRPORT LIGHTING SYSTEMS

Available pilot controlled lighting (PCL) systems are indicated as follows:

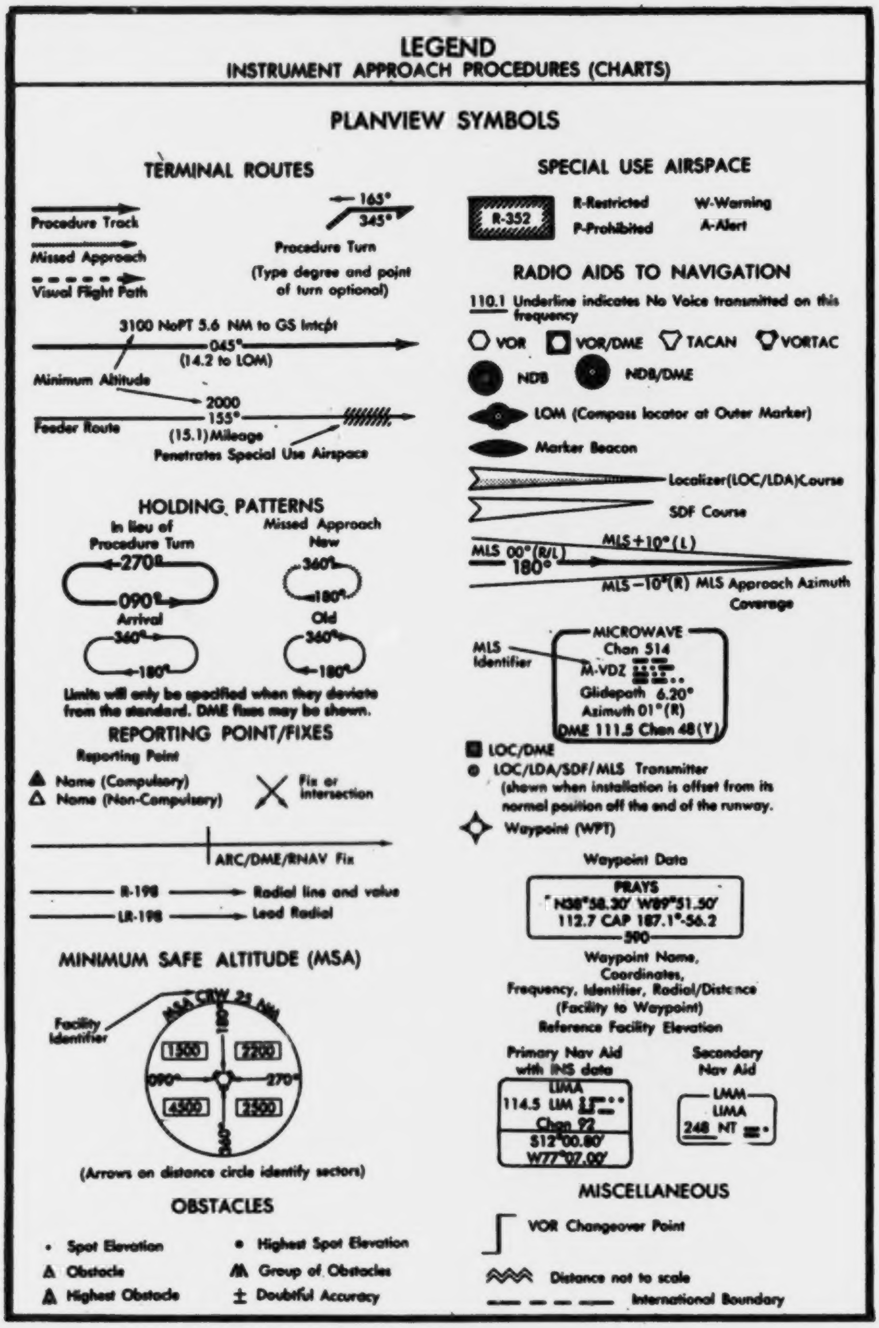
1. Approach lighting systems that bear a system identification are symbolized using negative symbology, e.g., ●, ●, ●
2. Approach lighting systems that do not bear a system identification are indicated with a negative " ● " beside the name.

A star (*) indicates non-standard PCL, consult Directory/Supplement, e.g., ●*

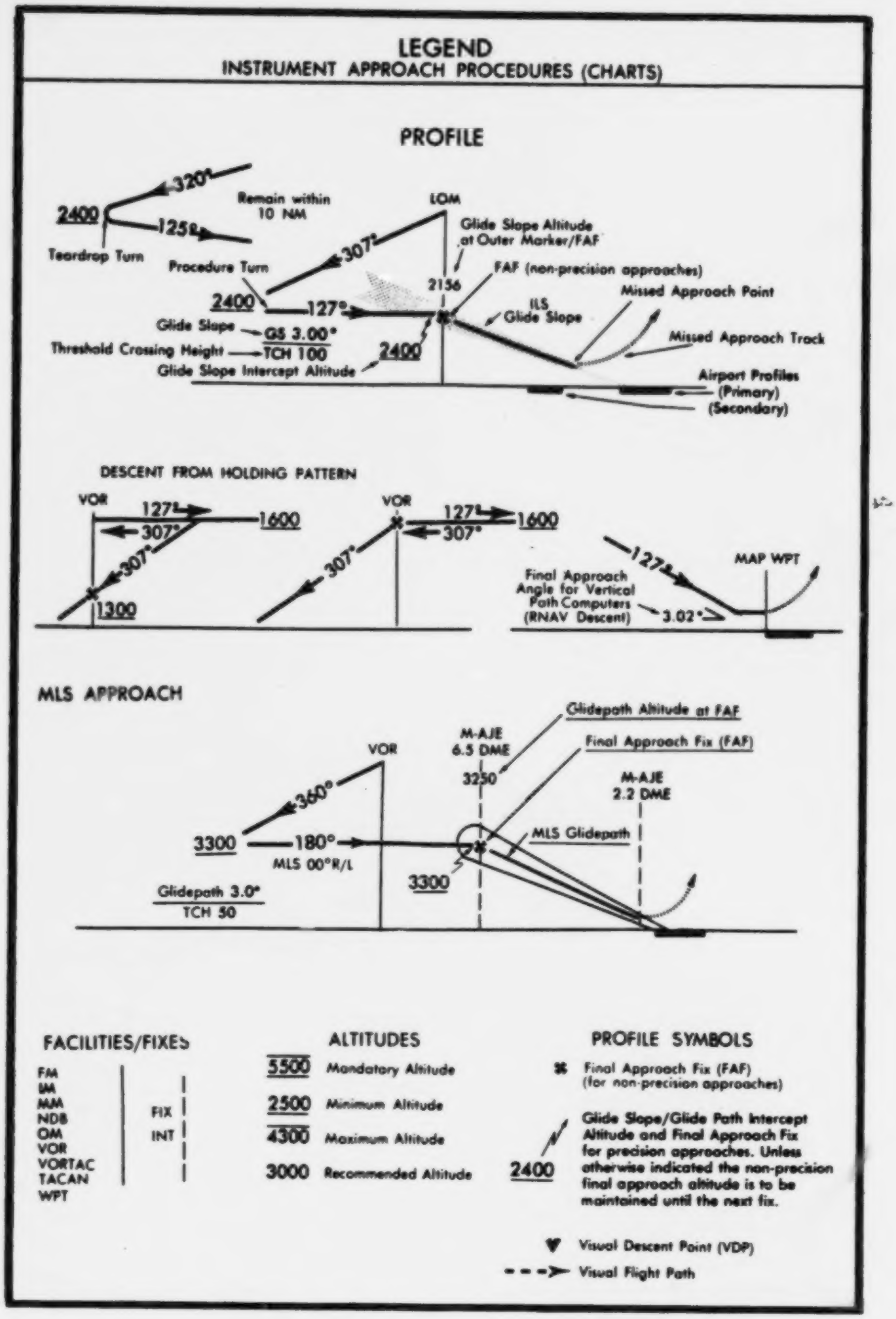
To activate lights use frequency indicated in the communication section of the chart with a ● or the appropriate lighting system identification e.g., UNICOM 122.8 ●, ●, ●

| KEY MIKE | FUNCTION |
|---|---|
| 7 times within 5 seconds | Highest intensity available |
| 5 times within 5 seconds | Medium or lower intensity (Lower REIL or REIL-oft, |
| 3 times within 5 seconds | Lowest intensity available (Lower REIL or REIL-off) |

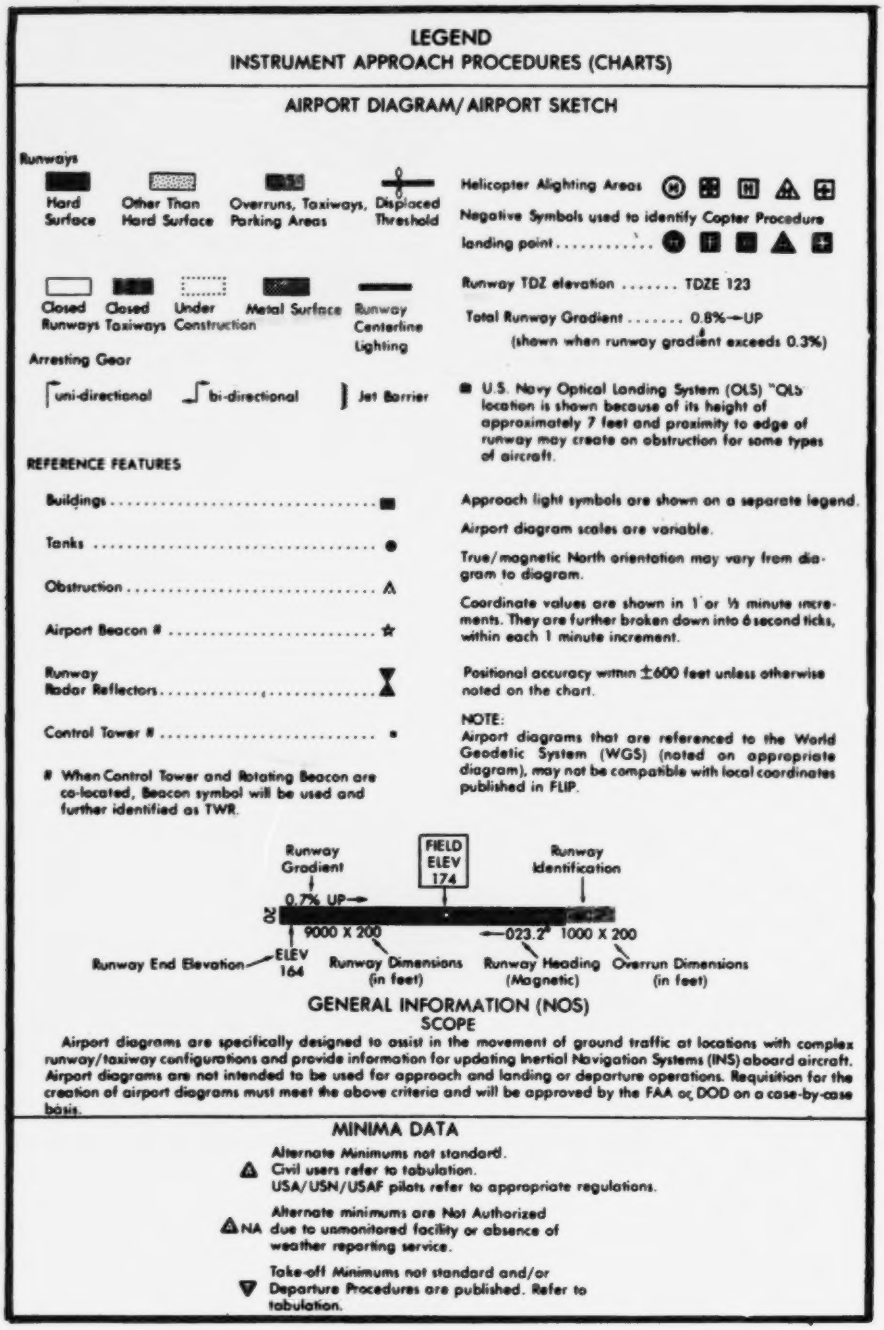
LEGEND 2.—General Information and Abbreviations.


LEGEND
INSTRUMENT APPROACH PROCEDURES (CHARTS)
PLANVIEW SYMBOLS
TERMINAL ROUTES
Procedure Track
Missed Approach
Visual Flight Path
165°
345°
Procedure Turn
(Type degree and point of turn optional)
3100 NoPT 5.6 NM to GS Intcpt
045°
(14.2 to LOM)
Minimum Altitude
2000
155°
Feeder Route
(15.1) Mileage
Penetrates Special Use Airspace
HOLDING PATTERNS
In lieu of Procedure Turn
270°
090°
Arrival
360°
180°
Missed Approach
New
360°
180°
Old
360°
180°
Limits will only be specified when they deviate from the standard. DME fixes may be shown.
REPORTING POINT/FIXES
Reporting Point
Name (Compulsory)
Name (Non-Compulsory)
Fix or intersection
ARC/DME/RNAV Fix
R-198
Radial line and value
LR-198
Lead Radial
MINIMUM SAFE ALTITUDE (MSA)
Facility Identifier
MSA CRW 25 NM
180
1500
2200
090°
270°
4500
2500
360°
(Arrows on distance circle identify sectors)
OBSTACLES
Spot Elevation
Obstacle
Highest Obstacle
Highest Spot Elevation
Group of Obstacles
Doubtful Accuracy
SPECIAL USE AIRSPACE
R-352
R-Restricted
P-Prohibited
W-Warning
A-Alert
RADIO AIDS TO NAVIGATION
110.1 Underline indicates No Voice transmitted on this frequency
VOR
VOR/DME
TACAN
VORTAC
NDB
NDB/DME
LOM (Compass locator at Outer Marker)
Marker Beacon
Localizer(LOC/LDA)Course
SDF Course
MLS 00°(R/L)
180°
MLS +10° (L)
MLS −10°(R) MLS Approach Azimuth Coverage
MLS Identifier
MICROWAVE
Chan 514
M-VDZ
Glidepath 6.20°
Azimuth 01°(R)
DME 111.5 Chan 48(Y)
LOC/DME
LOC/LDA/SDF/MLS Transmitter (shown when installation is offset from its normal position off the end of the runway.
Waypoint (WPT)
Waypoint Data
PRAYS
N38°58.30' W89°51.50'
112.7 CAP 187.1°-56.2
590
Waypoint Name, Coordinates, Frequency, Identifier, Radial/Distance (Facility to Waypoint) Reference Facility Elevation
Primary Nav Aid with INS data
LIMA
114.5 LIM
Chan 92
S12°00.80'
W77°07.00'
Secondary Nav Aid
LMM
LIMA
248 NT
MISCELLANEOUS
VOR Changeover Point
Distance not to scale
International Boundary

LEGEND 3.—Instrument Approach Procedures Chart (Planview).


LEGEND
INSTRUMENT APPROACH PROCEDURES (CHARTS)
PROFILE
2400
320°
125°
Remain within 10 NM
Teardrop Turn
Procedure Turn
LOM
307°
Glide Slope Altitude at Outer Marker/FAF
FAF (non-precision approaches)
2156
2400
127°
ILS Glide Slope
Missed Approach Point
Missed Approach Track
Glide Slope
GS 3.00°
Threshold Crossing Height
TCH 100
2400
Glide Slope Intercept Altitude
Airport Profiles
(Primary)
(Secondary)
DESCENT FROM HOLDING PATTERN
VOR
127°
307°
1600
307°
1300
VOR
127°
1600
307°
307°
127°
MAP WPT
Final Approach Angle for Vertical Path Computers (RNAV Descent)
3.02°
MLS APPROACH
Glidepath Altitude at FAF
Final Approach Fix (FAF)
M-AJE 6.5 DME
VOR
3250
M-AJE 2.2 DME
360°
MLS Glidepath
3300
180°
MLS 00°R/L
3300
Glidepath 3.0°
TCH 50
FACILITIES/FIXES
FM
IM
MM
NDB
OM
VOR
VORTAC
TACAN
WPT
FIX
INT
ALTITUDES
5500 Mandatory Altitude
2500 Minimum Altitude
4300 Maximum Altitude
3000 Recommended Altitude
PROFILE SYMBOLS
Final Approach Fix (FAF) (for non-precision approaches)
2400
Glide Slope/Glide Path Intercept Altitude and Final Approach Fix for precision approaches. Unless otherwise indicated the non-precision final approach altitude is to be maintained until the next fix.
Visual Descent Point (VDP)
Visual Flight Path

LEGEND 4.—Instrument Approach Procedures Chart (Profile).



## LEGEND
## INSTRUMENT APPROACH PROCEDURES (CHARTS)

### AIRPORT DIAGRAM/AIRPORT SKETCH

**Runways**

| | |
|---|---|
| ■ | Hard Surface |
| ▨ | Other Than Hard Surface |
| ■ | Overruns, Taxiways, Parking Areas |
| ╪ | Displaced Threshold |
| ☐ | Closed Runways |
| ■ | Closed Taxiways |
| ⬚ | Under Construction |
| ▨ | Metal Surface |
| ▬ | Runway Centerline Lighting |

**Arresting Gear**

⌈ uni-directional ⌡⌈ bi-directional ] Jet Barrier

**REFERENCE FEATURES**

| | |
|---|---|
| Buildings | ■ |
| Tanks | ● |
| Obstruction | Λ |
| Airport Beacon # | ☆ |
| Runway Radar Reflectors | ⧗ |
| Control Tower # | • |

# When Control Tower and Rotating Beacon are co-located, Beacon symbol will be used and further identified as TWR.

Helicopter Alighting Areas Ⓗ ⊞ [H] △ ⊞

Negative Symbols used to identify Copter Procedure landing point ............ ● ■ ■ ▲ ■

Runway TDZ elevation ....... TDZE 123

Total Runway Gradient ....... 0.8%→UP

(shown when runway gradient exceeds 0.3%)

■ U.S. Navy Optical Landing System (OLS) "OLS" location is shown because of its height of approximately 7 feet and proximity to edge of runway may create an obstruction for some types of aircraft.

Approach light symbols are shown on a separate legend.

Airport diagram scales are variable.

True/magnetic North orientation may vary from diagram to diagram.

Coordinate values are shown in 1' or ½ minute increments. They are further broken down into 6 second ticks, within each 1 minute increment.

Positional accuracy within ±600 feet unless otherwise noted on the chart.

NOTE:
Airport diagrams that are referenced to the World Geodetic System (WGS) (noted on appropriate diagram), may not be compatible with local coordinates published in FLIP.

Runway Gradient

0.7% UP→

FIELD ELEV 174

Runway Identification

20

9000 X 200

←023.2° 1000 X 200

Runway End Elevation — ELEV 164

Runway Dimensions (in feet)

Runway Heading (Magnetic)

Overrun Dimensions (in feet)

### GENERAL INFORMATION (NOS)
### SCOPE

Airport diagrams are specifically designed to assist in the movement of ground traffic at locations with complex runway/taxiway configurations and provide information for updating Inertial Navigation Systems (INS) aboard aircraft. Airport diagrams are not intended to be used for approach and landing or departure operations. Requisition for the creation of airport diagrams must meet the above criteria and will be approved by the FAA or DOD on a case-by-case basis.

### MINIMA DATA

| | |
|---|---|
| △ | Alternate Minimums not standard.<br>Civil users refer to tabulation.<br>USA/USN/USAF pilots refer to appropriate regulations. |
| △NA | Alternate minimums are Not Authorized due to unmonitored facility or absence of weather reporting service. |
| ▼ | Take-off Minimums not standard and/or Departure Procedures are published. Refer to tabulation. |

LEGEND 5.—Instrument Approach Procedures Chart (Airport Diagram).

## INSTRUMENT APPROACH PROCEDURE CHARTS
## RATE OF DESCENT TABLE
(ft. per min.)

A rate of descent table is provided for use in planning and executing precision descents under known or approximate ground speed conditions. It will be especially useful for approaches when the localizer only is used for course guidance. A best speed, power, attitude combination can be programmed which will result in a stable glide rate and attitude favorable for executing a landing if minimums exist upon breakout. Care should always be exercised so that the minimum descent altitude and missed approach point are not exceeded.

| ANGLE OF DESCENT (degrees and tenths) | GROUND SPEED (knots) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 30 | 45 | 60 | 75 | 90 | 105 | 120 | 135 | 150 | 165 | 180 |
| 2.0 | 105 | 160 | 210 | 265 | 320 | 370 | 425 | 475 | 530 | 585 | 635 |
| 2.5 | 130 | 200 | 265 | 330 | 395 | 465 | 530 | 595 | 665 | 730 | 795 |
| 3.0 | 160 | 240 | 320 | 395 | 480 | 555 | 635 | 715 | 795 | 875 | 955 |
| 3.5 | 185 | 280 | 370 | 465 | 555 | 650 | 740 | 835 | 925 | 1020 | 1110 |
| 4.0 | 210 | 315 | 425 | 530 | 635 | 740 | 845 | 955 | 1060 | 1165 | 1270 |
| 4.5 | 240 | 355 | 475 | 595 | 715 | 835 | 955 | 1075 | 1190 | 1310 | 1430 |
| 5.0 | 265 | 395 | 530 | 660 | 795 | 925 | 1060 | 1190 | 1325 | 1455 | 1590 |
| 5.5 | 290 | 435 | 580 | 730 | 875 | 1020 | 1165 | 1310 | 1455 | 1600 | 1745 |
| 6.0 | 315 | 475 | 635 | 795 | 955 | 1110 | 1270 | 1430 | 1590 | 1745 | 1905 |
| 6.5 | 345 | 515 | 690 | 860 | 1030 | 1205 | 1375 | 1550 | 1720 | 1890 | 2065 |
| 7.0 | 370 | 555 | 740 | 925 | 1110 | 1295 | 1480 | 1665 | 1850 | 2035 | 2220 |
| 7.5 | 395 | 595 | 795 | 990 | 1190 | 1390 | 1585 | 1785 | 1985 | 2180 | 2380 |
| 8.0 | 425 | 635 | 845 | 1055 | 1270 | 1480 | 1690 | 1905 | 2115 | 2325 | 2540 |
| 8.5 | 450 | 675 | 900 | 1120 | 1345 | 1570 | 1795 | 2020 | 2245 | 2470 | 2695 |
| 9.0 | 475 | 715 | 950 | 1190 | 1425 | 1665 | 1900 | 2140 | 2375 | 2615 | 2855 |
| 9.5 | 500 | 750 | 1005 | 1255 | 1505 | 1755 | 2005 | 2255 | 2510 | 2760 | 3010 |
| 10.0 | 530 | 790 | 1055 | 1320 | 1585 | 1845 | 2110 | 2375 | 2640 | 2900 | 3165 |
| 10.5 | 555 | 830 | 1105 | 1385 | 1660 | 1940 | 2215 | 2490 | 2770 | 3045 | 3320 |
| 11.0 | 580 | 870 | 1160 | 1450 | 1740 | 2030 | 2320 | 2610 | 2900 | 3190 | 3480 |
| 11.5 | 605 | 910 | 1210 | 1515 | 1820 | 2120 | 2425 | 2725 | 3030 | 3335 | 3635 |
| 12.0 | 630 | 945 | 1260 | 1575 | 1890 | 2205 | 2520 | 2835 | 3150 | 3465 | 3780 |

LEGEND 6.—Rate-of-Descent Table.

## INSTRUMENT TAKEOFF PROCEDURE CHARTS
## RATE OF CLIMB TABLE
### (ft. per min.)

A rate of climb table is provided for use in planning and executing takeoff procedures under known or approximate ground speed conditions.

| REQUIRED CLIMB RATE (ft. per NM) | GROUND SPEED (KNOTS) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 30 | 60 | 80 | 90 | 100 | 120 | 140 |
| 200 | 100 | 200 | 267 | 300 | 333 | 400 | 467 |
| 250 | 125 | 250 | 333 | 375 | 417 | 500 | 583 |
| 300 | 150 | 300 | 400 | 450 | 500 | 600 | 700 |
| 350 | 175 | 350 | 467 | 525 | 583 | 700 | 816 |
| 400 | 200 | 400 | 533 | 600 | 667 | 800 | 933 |
| 450 | 225 | 450 | 600 | 675 | 750 | 900 | 1050 |
| 500 | 250 | 500 | 667 | 750 | 833 | 1000 | 1167 |
| 550 | 275 | 550 | 733 | 825 | 917 | 1100 | 1283 |
| 600 | 300 | 600 | 800 | 900 | 1000 | 1200 | 1400 |
| 650 | 325 | 650 | 867 | 975 | 1083 | 1300 | 1516 |
| 700 | 350 | 700 | 933 | 1050 | 1167 | 1400 | 1633 |

| REQUIRED CLIMB RATE (ft. per NM) | GROUND SPEED (KNOTS) | | | | | |
|---|---|---|---|---|---|---|
| | 150 | 180 | 210 | 240 | 270 | 300 |
| 200 | 500 | 600 | 700 | 800 | 900 | 1000 |
| 250 | 625 | 750 | 875 | 1000 | 1125 | 1250 |
| 300 | 750 | 900 | 1050 | 1200 | 1350 | 1500 |
| 350 | 875 | 1050 | 1225 | 1400 | 1575 | 1750 |
| 400 | 1000 | 1200 | 1400 | 1600 | 1700 | 2000 |
| 450 | 1125 | 1350 | 1575 | 1800 | 2025 | 2250 |
| 500 | 1250 | 1500 | 1750 | 2000 | 2250 | 2500 |
| 550 | 1375 | 1650 | 1925 | 2200 | 2475 | 2750 |
| 600 | 1500 | 1800 | 2100 | 2400 | 2700 | 3000 |
| 650 | 1625 | 1950 | 2275 | 2600 | 2925 | 3250 |
| 700 | 1750 | 2100 | 2450 | 2800 | 3150 | 3500 |

LEGEND 7.—Rate-of-Climb Table.

### Instrument Approach Procedures (Charts)
### INOPERATIVE COMPONENTS OR VISUAL AIDS TABLE

Landing minimums published on instrument approach procedure charts are based upon full operation of all components and visual aids associated with the particular instrument approach chart being used. Higher minimums are required with inoperative components or visual aids as indicated below. If more than one component is inoperative, each minimum is raised to the highest minimum required by any single component that is inoperative. ILS glide slope inoperative minimums are published on instrument approach charts as localizer minimums. This table may be amended by notes on the approach chart. Such notes apply only to the particular approach category(ies) as stated. See legend page for description of components indicated below.

(1) ILS, MLS, and PAR

| Inoperative Component or Aid | Approach Category | Increase DH | Increase Visibility |
|---|---|---|---|
| MM* | ABC | 50 feet | None |
| MM* | D | 50 feet | ¼ mile |
| ALSF 1 & 2, MALSR, & SSALR | ABCD | None | ¼ mile |

*Not applicable to PAR

(2) ILS with visibility minimum of 1,800 or 2,000 RVR.

| | | | |
|---|---|---|---|
| MM | ABC | 50 feet | To 2400 RVR |
| MM | D | 50 feet | To 4000 RVR |
| ALSF 1 & 2, MALSR, & SSALR | ABCD | None | To 4000 RVR |
| TDZL, RCLS | ABCD | None | To 2400 RVR |
| RVR | ABCD | None | To ½ mile |

(3) VOR, VOR/DME, VORTAC, VOR (TAC), VOR/DME (TAC), LOC, LOC/DME, LDA, LDA/DME, SDF, SDF/DME, RNAV, and ASR

| Inoperative Visual Aid | Approach Category | Increase MDA | Increase Visibility |
|---|---|---|---|
| ALSF 1 & 2, MALSR, & SSALR | ABCD | None | ½ mile |
| SSALS, MALS & ODALS | ABC | None | ¼ mile |

(4) NDB

| | | | |
|---|---|---|---|
| ALSF 1 & 2, MALSR, & SSALR | C | None | ½ mile |
| | ABD | None | ¼ mile |
| MALS, SSALS, ODALS | ABC | None | ¼ mile |

LEGEND 8.—Inoperative Components or Visual Aids Table.

# INSTRUMENT APPROACH PROCEDURES EXPLANATION OF TERMS

The United States Standard for Terminal Instrument Procedures (TERPS) is the approved criteria for formulating instrument approach procedures.

## AIRCRAFT APPROACH CATEGORIES

Speeds are based on 1.3 times the stall speed in the landing configuration at maximum gross landing weight. An aircraft shall fit in only one category. If it is necessary to maneuver at speeds in excess of the upper limit of a speed range for a category, the minimums for the next higher category should be used. For example, an aircraft which falls in Category A, but is circling to land at a speed in excess of 91 knots, should use the approach Category B minimums when circling to land. See following category limits:

### MANEUVERING TABLE

| Approach Category | A | B | C | D | E |
|---|---|---|---|---|---|
| Speed (Knots) | 0-90 | 91-120 | 121-140 | 141-165 | Abv 165 |

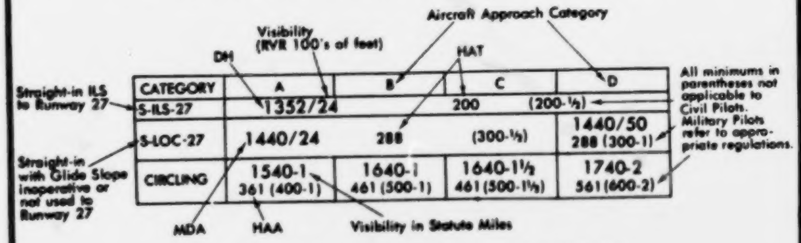
## RVR/Meteorological Visibility Comparable Values

The following table shall be used for converting RVR to meteorlogical visibility when RVR is not reported for the runway of intended operation. Adjustment of landing minima may be required – see Inoperative Components Table.

| RVR (feet) | Visibility (statute miles) | RVR (feet) | Visibility (statute miles) |
|---|---|---|---|
| 1600 | ¼ | 4500 | ⅞ |
| 2400 | ½ | 5000 | 1 |
| 3200 | ⅝ | 6000 | 1¼ |
| 4000 | ¾ | | |

## LANDING MINIMA FORMAT

In this example airport elevation is 1179, and runway touchdown zone elevation is 1152.


Aircraft Approach Category
Visibility (RVR 100's of feet)
DH
HAT
Straight-in ILS to Runway 27
Straight-in with Glide Slope inoperative or not used to Runway 27
All minimums in parentheses not applicable to Civil Pilots. Military Pilots refer to appropriate regulations.
MDA
HAA
Visibility in Statute Miles

| CATEGORY | A | B | C | D |
|---|---|---|---|---|
| S-ILS-27 | 1352/24 | | 200 | (200-½) |
| S-LOC-27 | 1440/24 | 288 | (300-½) | 1440/50<br>288 (300-1) |
| CIRCLING | 1540-1<br>361 (400-1) | 1640-1<br>461 (500-1) | 1640-1½<br>461 (500-1½) | 1740-2<br>561 (600-2) |

## CORRECTIONS, COMMENTS AND/OR PROCUREMENT

FOR CHARTING ERRORS:

Contact National Ocean Service
NOAA, N/CG31
6010 Executive Blvd.
Rockville, MD. 20852
Telephone Toll -Free 800-626-3677

FOR CHANGES, ADDITIONS, OR RECOMMENDATIONS ON PROCEDURAL ASPECTS:

Contact Federal Aviation Administration, ATO-258
800 Independence Avenue, S.W.
Washington, D.C. 20591
Telephone (202) 267-9297

PROCURE FROM:

National Ocean Service
NOAA, N/CG33
Distribution Branch
Riverdale, MD. 20737
Telephone (301) 436-6993

▼ ▼

7351

INSTRUMENT APPROACH PROCEDURES (CHARTS)

## ▼IFR TAKE-OFF MINIMUMS AND DEPARTURE PROCEDURES

Civil Airports and Selected Military Airports

CIVIL USERS: FAR 91 prescribes take-off rules and establishes take-off minimums as follows: (1) Aircraft having two engines or less – one statute mile. (2) Aircraft having more than two engines – one-half statute mile.

MILITARY USERS: Special IFR departure procedures, not published as Standard Instrument Departure (SIDs), and civil take-off minima are included below and are established to assist pilots in obstruction avoidance. Refer to appropriate service directives for take-off minimums.

Airports with IFR take-off minimums other than standard are listed below. Departure procedures and/or ceiling visibility minimums are established to assist pilots conducting IFR flight in avoiding obstructions during climb to the minimum enroute altitude. Take-off minimums and departures apply to all runways unless otherwise specified. Altitudes, unless otherwise indicated, are minimum altitudes in feet MSL.

▲ ▲

87295

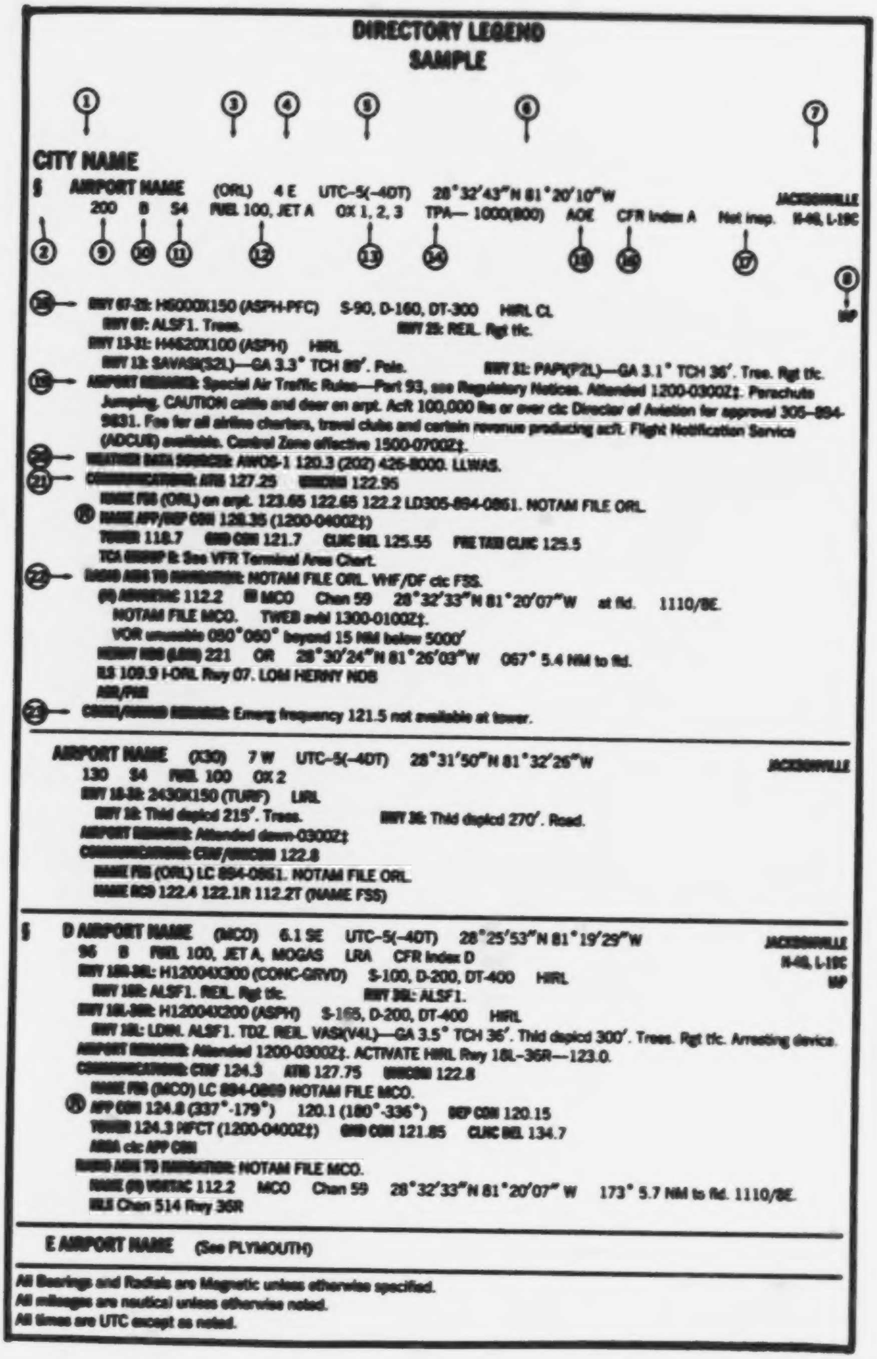
INSTRUMENT APPROACH PROCEDURES (CHARTS)

## ▲IFR ALTERNATE MINIMUMS

(NOT APPLICABLE TO USA/USN/USAF)

Standard alternate minimums for nonprecision approaches are 800-2 (NDB, VOR, LOC, TACAN, LDA, VORTAC, VOR/DME or ASR); for precision approaches 600-2 (ILS or PAR). Airports within this geographical area that require alternate minimums other than standard or alternate minimums with restrictions are listed below. NA - means alternate minimums are not authorized due to unmonitored facility or absence of weather reporting service. Civil pilots see FAR 91. USA/USN/USAF pilots refer to appropriate regulations.

LEGEND 9.—Instrument Approach Procedures Explanation of Terms.


①
③
④
⑤
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⑮
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⑧
⑱
⑲
⑳
㉑
㉒
㉓

**DIRECTORY LEGEND**
**SAMPLE**

**CITY NAME**
§ **AIRPORT NAME** (ORL) 4 E UTC–5(–4DT) 28°32′43″N 81°20′10″W **JACKSONVILLE**
200 B S4 **FUEL** 100, JET A OX 1, 2, 3 TPA—1000(800) AOE CFR Index A Not insp. **H-4G, L-19C**
**IAP**

**RWY 07-25:** H6000X150 (ASPH-PFC) S-90, D-160, DT-300 HIRL CL
**RWY 07:** ALSF1. Trees. **RWY 25:** REIL. Rgt tfc.
**RWY 13-31:** H4620X100 (ASPH) HIRL
**RWY 13:** SAVASI(S2L)—GA 3.3° TCH 89′. Pole. **RWY 31:** PAPI(P2L)—GA 3.1° TCH 36′. Tree. Rgt tfc.
**AIRPORT REMARKS:** Special Air Traffic Rules—Part 93, see Regulatory Notices. Attended 1200-0300Z‡. Parachute Jumping. CAUTION cattle and deer on arpt. Acft 100,000 lbs or over ctc Director of Aviation for approval 305–894-9831. Fee for all airline charters, travel clubs and certain revenue producing acft. Flight Notification Service (ADCUS) available. Control Zone effective 1500-0700Z‡.
**WEATHER DATA SOURCES:** AWOS-1 120.3 (202) 426-8000. LLWAS.
**COMMUNICATIONS: ATIS** 127.25 **UNICOM** 122.95
**NAME FSS** (ORL) on arpt. 123.65 122.65 122.2 LD305-894-0861. NOTAM FILE ORL.
Ⓡ **NAME APP/DEP CON** 128.35 (1200-0400Z‡)
**TOWER** 118.7 **GND CON** 121.7 **CLNC DEL** 125.55 **PRE TAXI CLNC** 125.5
**TCA GROUP II:** See VFR Terminal Area Chart.
**RADIO AIDS TO NAVIGATION:** NOTAM FILE ORL. VHF/DF ctc FSS.
**(H) ABVORTAC** 112.2 **MCO** Chan 59 28°32′33″N 81°20′07″W at fld. 1110/8E.
NOTAM FILE MCO. TWEB avbl 1300-0100Z‡.
VOR unusable 030°-060° beyond 15 NM below 5000′
**HERNY NDB (LOM)** 221 OR 28°30′24″N 81°26′03″W 067° 5.4 NM to fld.
**ILS** 109.9 I-ORL Rwy 07. LOM HERNY NDB
**ASR/PAR**
**COMM/NAVAID REMARKS:** Emerg frequency 121.5 not available at tower.

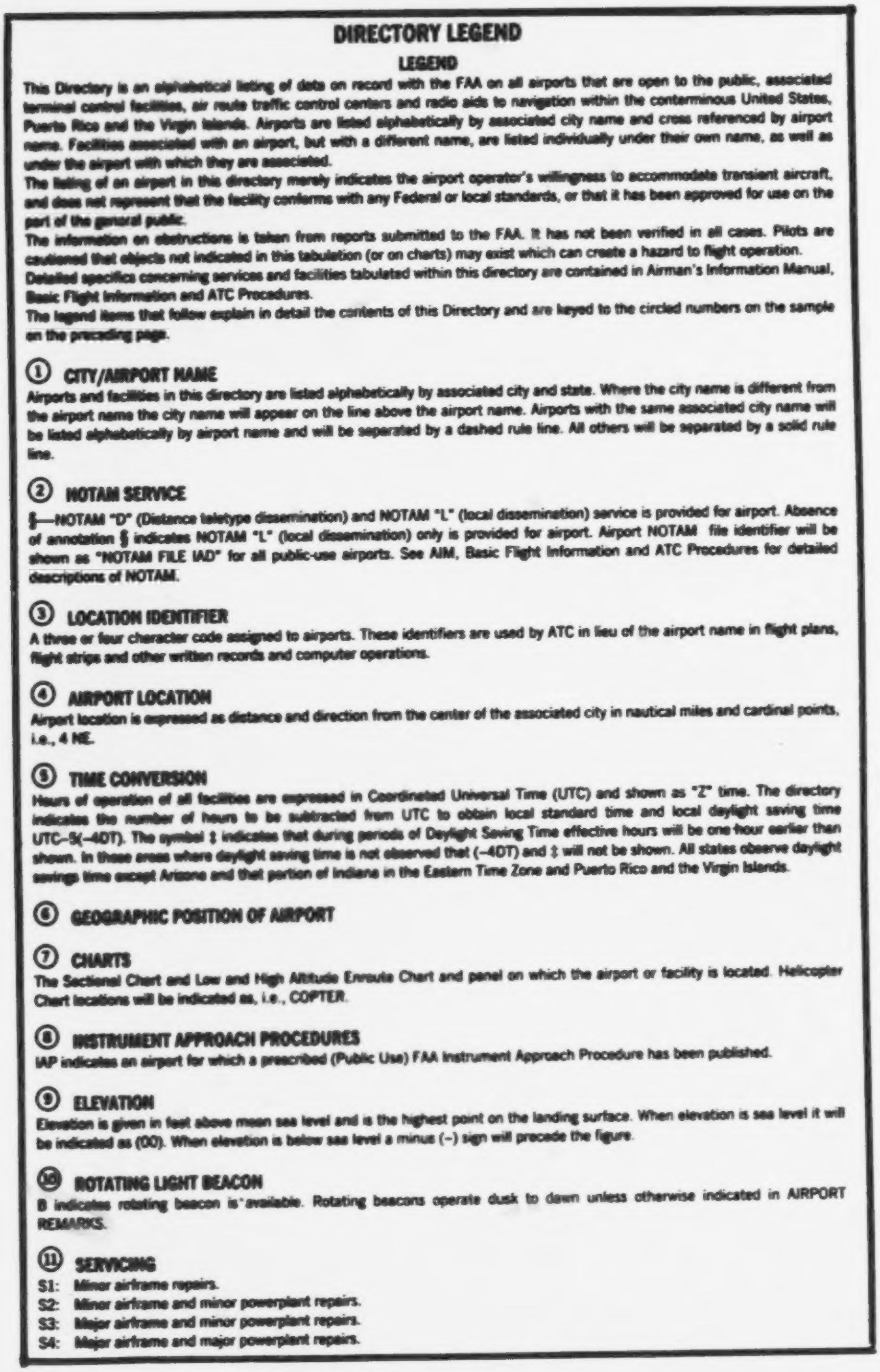
**AIRPORT NAME** (X30) 7 W UTC–5(–4DT) 28°31′50″N 81°32′26″W **JACKSONVILLE**
130 S4 **FUEL** 100 OX 2
**RWY 18-36:** 2430X150 (TURF) LIRL
**RWY 18:** Thld dsplcd 215′. Trees. **RWY 36:** Thld dsplcd 270′. Road.
**AIRPORT REMARKS:** Attended dawn-0300Z‡
**COMMUNICATIONS: CTAF/UNICOM** 122.8
**NAME FSS** (ORL) LC 894-0861. NOTAM FILE ORL.
**NAME RCO** 122.4 122.1R 112.2T (NAME FSS)

§ **D AIRPORT NAME** (MCO) 6.1 SE UTC–5(–4DT) 28°25′53″N 81°19′29″W **JACKSONVILLE**
96 B **FUEL** 100, JET A, MOGAS LRA CFR Index D **H-4G, L-19C**
**RWY 18R-36L:** H12004X300 (CONC-GRVD) S-100, D-200, DT-400 HIRL **IAP**
**RWY 18R:** ALSF1. REIL. Rgt tfc. **RWY 36L:** ALSF1.
**RWY 18L-36R:** H12004X200 (ASPH) S-165, D-200, DT-400 HIRL
**RWY 18L:** LDIN. ALSF1. TDZ. REIL. VASI(V4L)—GA 3.5° TCH 36′. Thld dsplcd 300′. Trees. Rgt tfc. Arresting device.
**AIRPORT REMARKS:** Attended 1200-0300Z‡. ACTIVATE HIRL Rwy 18L–36R—123.0.
**COMMUNICATIONS: CTAF** 124.3 **ATIS** 127.75 **UNICOM** 122.8
**NAME FSS** (MCO) LC 894-0869 NOTAM FILE MCO.
Ⓡ **APP CON** 124.8 (337°-179°) 120.1 (180°-336°) **DEP CON** 120.15
**TOWER** 124.3 NFCT (1200-0400Z‡) **GND CON** 121.85 **CLNC DEL** 134.7
**ARSA** ctc **APP CON**
**RADIO AIDS TO NAVIGATION:** NOTAM FILE MCO.
**NAME (H) VORTAC** 112.2 MCO Chan 59 28°32′33″N 81°20′07″ W 173° 5.7 NM to fld. 1110/8E.
**MLS** Chan 514 Rwy 36R

**E AIRPORT NAME** (See PLYMOUTH)

All Bearings and Radials are Magnetic unless otherwise specified.
All mileages are nautical unless otherwise noted.
All times are UTC except as noted.

LEGEND 10.—Directory Legend (Sample).



## DIRECTORY LEGEND

### LEGEND

This Directory is an alphabetical listing of data on record with the FAA on all airports that are open to the public, associated terminal control facilities, air route traffic control centers and radio aids to navigation within the conterminous United States, Puerto Rico and the Virgin Islands. Airports are listed alphabetically by associated city name and cross referenced by airport name. Facilities associated with an airport, but with a different name, are listed individually under their own name, as well as under the airport with which they are associated.

The listing of an airport in this directory merely indicates the airport operator's willingness to accommodate transient aircraft, and does not represent that the facility conforms with any Federal or local standards, or that it has been approved for use on the part of the general public.

The information on obstructions is taken from reports submitted to the FAA. It has not been verified in all cases. Pilots are cautioned that objects not indicated in this tabulation (or on charts) may exist which can create a hazard to flight operation.

Detailed specifics concerning services and facilities tabulated within this directory are contained in Airman's Information Manual, Basic Flight Information and ATC Procedures.

The legend items that follow explain in detail the contents of this Directory and are keyed to the circled numbers on the sample on the preceding page.

### ① CITY/AIRPORT NAME

Airports and facilities in this directory are listed alphabetically by associated city and state. Where the city name is different from the airport name the city name will appear on the line above the airport name. Airports with the same associated city name will be listed alphabetically by airport name and will be seperated by a dashed rule line. All others will be separated by a solid rule line.

### ② NOTAM SERVICE

§—NOTAM "D" (Distance teletype dissemination) and NOTAM "L" (local dissemination) service is provided for airport. Absence of annotation § indicates NOTAM "L" (local dissemination) only is provided for airport. Airport NOTAM file identifier will be shown as "NOTAM FILE IAD" for all public-use airports. See AIM, Basic Flight Information and ATC Procedures for detailed descriptions of NOTAM.

### ③ LOCATION IDENTIFIER

A three or four character code assigned to airports. These identifiers are used by ATC in lieu of the airport name in flight plans, flight strips and other written records and computer operations.

### ④ AIRPORT LOCATION

Airport location is expressed as distance and direction from the center of the associated city in nautical miles and cardinal points, i.e., 4 NE.

### ⑤ TIME CONVERSION

Hours of operation of all facilities are expressed in Coordinated Universal Time (UTC) and shown as "Z" time. The directory indicates the number of hours to be subtracted from UTC to obtain local standard time and local daylight saving time UTC–5(–4DT). The symbol ‡ indicates that during periods of Daylight Saving Time effective hours will be one hour earlier than shown. In those areas where daylight saving time is not observed that (–4DT) and ‡ will not be shown. All states observe daylight savings time except Arizona and that portion of Indiana in the Eastern Time Zone and Puerto Rico and the Virgin Islands.

### ⑥ GEOGRAPHIC POSITION OF AIRPORT

### ⑦ CHARTS

The Sectional Chart and Low and High Altitude Enroute Chart and panel on which the airport or facility is located. Helicopter Chart locations will be indicated as, i.e., COPTER.

### ⑧ INSTRUMENT APPROACH PROCEDURES

IAP indicates an airport for which a prescribed (Public Use) FAA Instrument Approach Procedure has been published.

### ⑨ ELEVATION

Elevation is given in feet above mean sea level and is the highest point on the landing surface. When elevation is sea level it will be indicated as (00). When elevation is below sea level a minus (–) sign will precede the figure.

### ⑩ ROTATING LIGHT BEACON

B indicates rotating beacon is available. Rotating beacons operate dusk to dawn unless otherwise indicated in AIRPORT REMARKS.

### ⑪ SERVICING

S1: Minor airframe repairs.
S2: Minor airframe and minor powerplant repairs.
S3: Major airframe and minor powerplant repairs.
S4: Major airframe and major powerplant repairs.

LEGEND 11.—Directory Legend.

## DIRECTORY LEGEND

### ⑫ FUEL

| CODE | FUEL |
|---|---|
| 80 | Grade 80 gasoline (Red) |
| 100 | Grade 100 gasoline (Green) |
| 100LL | Grade 100LL gasoline (low lead) (Blue) |
| 115 | Grade 115 gasoline |
| A | Jet A—Kerosene freeze point–40° C. |
| A1 | Jet A-1 —Kerosene, freeze point–50° C. |
| A1 + | Jet A-1—Kerosene with icing inhibitor, freeze point–50° C. |
| MOGAS | Automobile gasoline which is to be used as aircraft fuel. |

| CODE | FUEL |
|---|---|
| B | Jet B—Wide-cut turbine fuel, freeze point–50° C. |
| B + | Jet B—Wide-cut turbine fuel with icing inhibitor, freeze point–50° C. |

NOTE: Automobile Gasoline. Certain automobile gasoline may be used in specific aircraft engines if a FAA supplemental type certificate has been obtained. Automobile gasoline which is to be used in aircraft engines will be identified as "MOGAS", however, the grade/type and other octane rating will not be published.

Data shown on fuel availability represents the most recent informtion the publisher has been able to acquire. Because of a variety of factors, the fuel listed may not always be obtainable by transient civil pilots. Confirmation of availability of fuel should be made directly with fuel dispensers at locations where refueling is planned.

### ⑬ OXYGEN

OX 1 High Pressure
OX 2 Low Pressure
OX 3 High Pressure—Replacement Bottles
OX 4 Low Pressure—Replacement Bottles

### ⑭ TRAFFIC PATTERN ALTITUDE

Traffic Pattern Altitude (TPA)—The first figure shown is TPA above mean sea level. The second figure in parentheses is TPA above airport elevation.

### ⑮ AIRPORT OF ENTRY AND LANDING RIGHTS AIRPORTS

AOE—Airport of Entry—A customs Airport of Entry where permission from U.S. Customs is not required, however, at least one hour advance notice of arrival must be furnished.

LRA—Landing Rights Airport—Application for permission to land must be submitted in advance to U.S. Customs. At least one hour advance notice of arrival must be furnished.

NOTE: Advance notice of arrival at both an AOE and LRA airport may be included in the flight plan when filed in Canada or Mexico, where Flight Notification Service (ADCUS) is available the airport remark will indicate this service. This notice will also be treated as an application for permission to land in the case of an LRA. Although advance notice of arrival may be relayed to Customs through Mexico, Canadian, and U.S. Communications facilities by flight plan, the aircraft operator is solely responsible for insuring that Customs receives the notification. (See Customs, Immigration and Naturalization, Public Health and Agriculture Department requirements in the International Flight Information Manual for further details.)

### ⑯ CERTIFICATED AIRPORT (FAR 139)

Airports serving Department of Transportation certified carriers and certified under FAR, Part 139, are indicated by the CFR index; i.e., CFR Index A, which relates to the availability of crash, fire, rescue equipment.

### FAR–PART 139 CERTIFICATED AIRPORTS

INDICES AND AIRCRAFT FIRE FIGHTING AND RESCUE EQUIPMENT REQUIREMENTS

| *Airport Index* | *Required No. Vehicles* | *Aircraft Length* | *Scheduled Departures* | *Agent + Water for Foam* |
|---|---|---|---|---|
| A | 1 | <90′ | ≥1 | 500#DC or HALON 1211<br>or 450#DC + 100 gal $H_2O$ |
| B | 1 or 2 | ≥90′, <126′ | ≥5 | Index A + 1500 gal $H_2O$ |
|  |  | ≥126′, <159′ | <5 |  |
| C | 2 or 3 | ≥126′, <159′ | ≥5 | Index A + 3000 gal $H_2O$ |
|  |  | ≥159′, <200′ | <5 |  |
| D | 3 | ≥159′, <200′<br>>200′ | ≥5<br><5 | Index A + 4000 gal $H_2O$ |
| E | 3 | ≥200′ | ≥5 | Index A + 6000 gal $H_2O$ |

> Greater Than; < Less Than; ≥ Equal or Greater Than; ≤ Equal or Less Than; $H_2O$–Water; DC–Dry Chemical.

LEGEND 12.—Directory Legend (Codes).

## DIRECTORY LEGEND

The listing of ARFF index does not necessarily assure coverage for non-air carrier operations or at other than prescribed times for air carrier. ARFF index Ltd.—indicates ARFF coverage may or may not be available, for information contact airport manager prior to flight.

### ⑰ FAA INSPECTION

All airports not inspected by FAA will be identified by the note: Not insp. This indicates that the airport information has been provided by the owner or operator of the field.

### ⑱ RUNWAY DATA

Runway information is shown on two lines. That information common to the entire runway is shown on the first line while information concerning the runway ends are shown on the second or following line. Lengthy information will be placed in the Airport Remarks.

Runway direction, surface, length, width, weight bearing capacity, lighting, gradient and appropriate remarks are shown for each runway. Direction, length, width, lighting and remarks are shown for sealanes. The full dimensions of helipads are shown, i.e., 50X150.

#### RUNWAY SURFACE AND LENGTH

Runway lengths prefixed by the letter "H" indicate that the runways are hard surfaced (concrete, asphalt). If the runway length is not prefixed, the surface is sod, clay, etc. The runway surface composition is indicated in parentheses after runway length as follows:

(AFSC)—Aggregate friction seal coat
(ASPH)—Asphalt
(CONC)—Concrete
(DIRT)—Dirt
(GRVD)—Grooved
(GRVL)—Gravel, or cinders
(PFC)—Porous friction courses
(RFSC)—Rubberized friction seal coat
(TURF)—Turf
(TRTD)—Treated
(WC)—Wire combed

#### RUNWAY WEIGHT BEARING CAPACITY

Runway strength data shown in this publication is derived from available information and is a realistic estimate of capability at an average level of activity. It is not intended as a maximum allowable weight or as an operating limitation. Many airport pavements are capable of supporting limited operations with gross weights of 25-50% in excess of the published figures. Permissible operating weights, insofar as runway strengths are concerned, are a matter of agreement between the owner and user. When desiring to operate into any airport at weights in excess of those published in the publication, users should contact the airport management for permission. Add 000 to figure following S, D, DT, DDT and MAX for gross weight capacity:

S—Runway weight bearing capacity for aircraft with single- wheel type landing gear, (DC-3), etc.
D—Runway weight bearing capacity for aircraft with dual-wheel type landing gear, (DC-6), etc.
DT—Runway weight bearing capacity for aircraft with dual-tandem type landing gear, (707), etc.
DDT—Runway weight bearing capacity for aircraft with double dual- tandem type landing gear, (747), etc.

Quadricycle and dual-tandem are considered virtually equal for runway weight bearing consideration, as are single-tandem and dual-wheel.

Omission of weight bearing capacity indicates information unknown.

#### RUNWAY LIGHTING

Lights are in operation sunset to sunrise. Lighting available by prior arrangement only or operating part of the night only and/or pilot controlled and with specific operating hours are indicated under airport remarks. Since obstructions are usually lighted, obstruction lighting is not included in this code. Unlighted obstructions on or surrounding an airport will be noted in airport remarks. Runway lights nonstandard (NSTD) are systems for which the light fixtures are not FAA approved L-800 series: color, intensity, or spacing does not meet FAA standards. Nonstandard runway lights, VASI, or any other system not listed below will be shown in airport remarks.

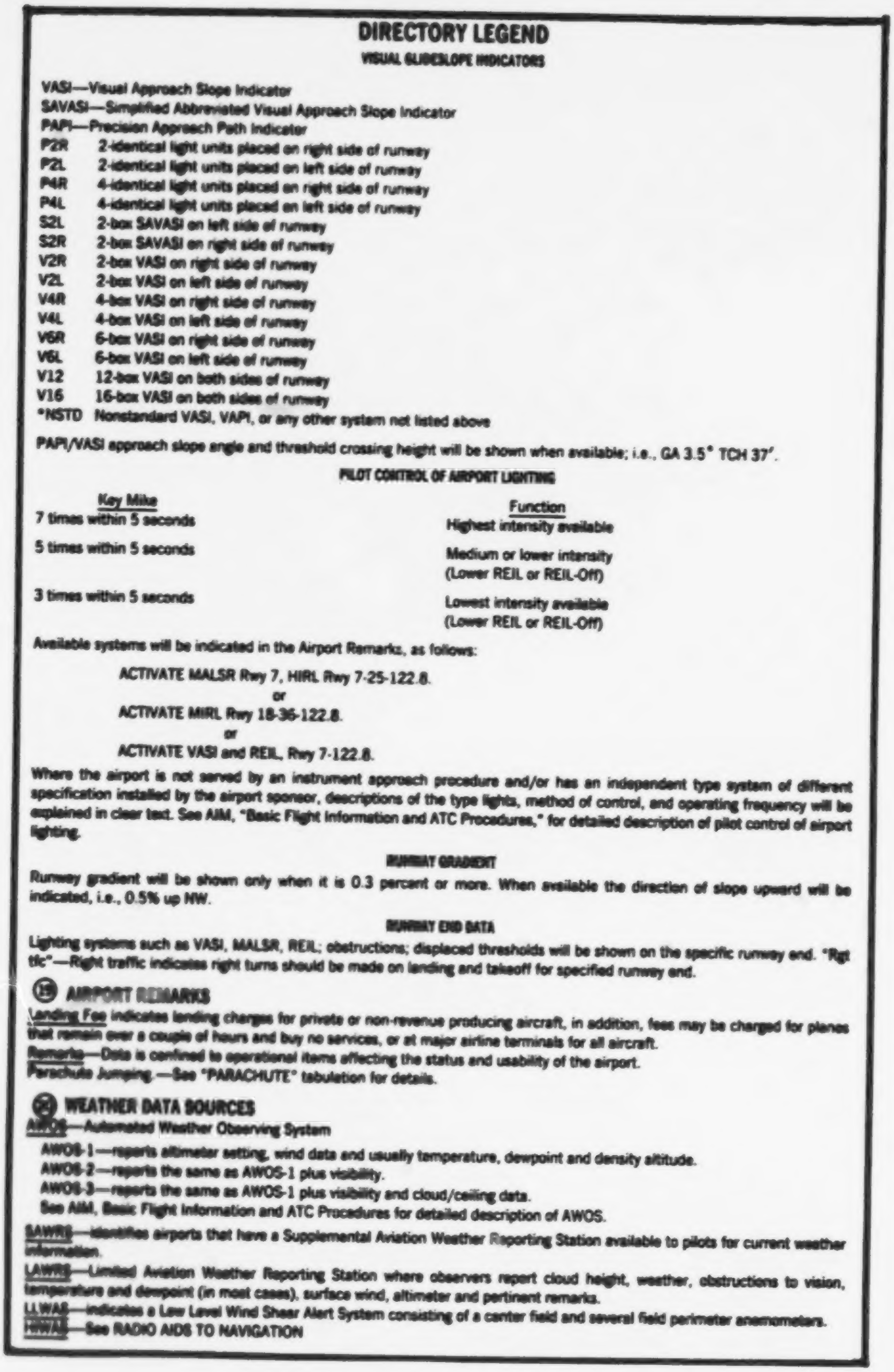
Temporary, emergency or limited runway edge lighting such as flares, smudge pots, lanterns or portable runway lights will also be shown in airport remarks.

Types of lighting are shown with the runway or runway end they serve.

NSTD—Light system fails to meet FAA standards.
LIRL—Low Intensity Runway Lights
MIRL—Medium Intensity Runway Lights
HIRL—High Intensity Runway Lights
REIL—Runway End Identifier Lights
CL—Centerline Lights
TDZ—Touchdown Zone Lights
ODALS—Omni Directional Approach Lighting System.
AF OVRN—Air Force Overrun 1000′ Standard Approach Lighting System.
LDIN—Lead-In Lighting System.
MALS—Medium Intensity Approach Lighting System.
MALSF—Medium Intensity Approach Lighting System with Sequenced Flashing Lights.
MALSR—Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights.
SALS—Short Approach Lighting System.
SALSF—Short Approach Lighting System with Sequenced Flashing Lights.
SSALS—Simplified Short Approach Lighting System.
SSALF—Simplified Short Approach Lighting System with Sequenced Flashing Lights.
SSALR—Simplified Short Approach Lighting System with Runway Alignment Indicator Lights.
ALSAF—High Intensity Approach Lighting System with Sequenced Flashing Lights
ALSF1—High Intensity Approach Lighting System with Sequenced Flashing Lights, Category I, Configuration.
ALSF2—High Intensity Approach Lighting System with Sequenced Flashing Lights, Category II, Configuration.
VASI—Visual Approach Slope Indicator System.

NOTE: Civil ALSF-2 may be operated as SSALR during favorable weather conditions.

LEGEND 13.—Directory Legend (Runway Data).



## DIRECTORY LEGEND

### VISUAL GLIDESLOPE INDICATORS

VASI—Visual Approach Slope Indicator
SAVASI—Simplified Abbreviated Visual Approach Slope Indicator
PAPI—Precision Approach Path Indicator

| | |
|---|---|
| P2R | 2-identical light units placed on right side of runway |
| P2L | 2-identical light units placed on left side of runway |
| P4R | 4-identical light units placed on right side of runway |
| P4L | 4-identical light units placed on left side of runway |
| S2L | 2-box SAVASI on left side of runway |
| S2R | 2-box SAVASI on right side of runway |
| V2R | 2-box VASI on right side of runway |
| V2L | 2-box VASI on left side of runway |
| V4R | 4-box VASI on right side of runway |
| V4L | 4-box VASI on left side of runway |
| V6R | 6-box VASI on right side of runway |
| V6L | 6-box VASI on left side of runway |
| V12 | 12-box VASI on both sides of runway |
| V16 | 16-box VASI on both sides of runway |
| *NSTD | Nonstandard VASI, VAPI, or any other system not listed above |

PAPI/VASI approach slope angle and threshold crossing height will be shown when available; i.e., GA 3.5° TCH 37′.

### PILOT CONTROL OF AIRPORT LIGHTING

| Key Mike | Function |
|---|---|
| 7 times within 5 seconds | Highest intensity available |
| 5 times within 5 seconds | Medium or lower intensity<br>(Lower REIL or REIL-Off) |
| 3 times within 5 seconds | Lowest intensity available<br>(Lower REIL or REIL-Off) |

Available systems will be indicated in the Airport Remarks, as follows:

ACTIVATE MALSR Rwy 7, HIRL Rwy 7-25-122.8.
or
ACTIVATE MIRL Rwy 18-36-122.8.
or
ACTIVATE VASI and REIL, Rwy 7-122.8.

Where the airport is not served by an instrument approach procedure and/or has an independent type system of different specification installed by the airport sponsor, descriptions of the type lights, method of control, and operating frequency will be explained in clear text. See AIM, "Basic Flight Information and ATC Procedures," for detailed description of pilot control of airport lighting.

### RUNWAY GRADIENT

Runway gradient will be shown only when it is 0.3 percent or more. When available the direction of slope upward will be indicated, i.e., 0.5% up NW.

### RUNWAY END DATA

Lighting systems such as VASI, MALSR, REIL; obstructions; displaced thresholds will be shown on the specific runway end. "Rgt tfc"—Right traffic indicates right turns should be made on landing and takeoff for specified runway end.

### ⑮ AIRPORT REMARKS

Landing Fee indicates landing charges for private or non-revenue producing aircraft, in addition, fees may be charged for planes that remain over a couple of hours and buy no services, or at major airline terminals for all aircraft.
Remarks—Data is confined to operational items affecting the status and usability of the airport.
Parachute Jumping.—See "PARACHUTE" tabulation for details.

### ⊗ WEATHER DATA SOURCES

AWOS—Automated Weather Observing System
AWOS-1—reports altimeter setting, wind data and usually temperature, dewpoint and density altitude.
AWOS-2—reports the same as AWOS-1 plus visibility.
AWOS-3—reports the same as AWOS-1 plus visibility and cloud/ceiling data.
See AIM, Basic Flight Information and ATC Procedures for detailed description of AWOS.

SAWRS—identifies airports that have a Supplemental Aviation Weather Reporting Station available to pilots for current weather information.

LAWRS—Limited Aviation Weather Reporting Station where observers report cloud height, weather, obstructions to vision, temperature and dewpoint (in most cases), surface wind, altimeter and pertinent remarks.

LLWAS—indicates a Low Level Wind Shear Alert System consisting of a center field and several field perimeter anemometers.

HIWAS—See RADIO AIDS TO NAVIGATION

LEGEND 14.—Directory Legend (Visual Glideslope Indicator).

## DIRECTORY LEGEND

### ㉑ COMMUNICATIONS

Communications will be listed in sequence in the order shown below:

Common Traffic Advisory Frequency (CTAF), Automatic Terminal Information Service (ATIS) and Aeronautical Advisory Stations (UNICOM) along with their frequency is shown, where available, on the line following the heading "COMMUNICATIONS." When the CTAF and UNICOM is the same frequency, the frequency will be shown as CTAF/UNICOM freq.

Flight Service Station (FSS) information. The associated FSS will be shown followed by the identifier and information concerning availability of telephone service, e.g., Direct Line (DL), Local Call (LC-384-2341), Long Distance (LD 202-426-8800 or LD 1-202-555-1212) etc. The airport NOTAM file identifier will be shown as "NOTAM FILE IAD." Where the FSS is located on the field it will be indicated as "on arpt" following the identifier. Frequencies available will follow. The FSS telephone number will follow along with any significant operational information. FSS's whose name is not the same as the airport on which located will also be listed in the normal alphabetical name listing for the state in which located. Remote Communications Outlet (RCO) providing service to the airport followed by the frequency and name of the Controlling FSS.

FSS's provide information on airport conditions, radio aids and other facilities, and process flight plans. Airport Advisory Service is provided on the CTAF by FSS's located at non-tower airports or airports where the tower is not in operation.

(See AIM, Par. 157/158 Traffic Advisory Practices at airports where a tower is not in operation or AC 90 - 42C.)

Aviation weather briefing service is provided by FSS specialists. Flight and weather briefing services are also available by calling the telephone numbers listed.

Remote Communications Outlet (RCO)—An unmanned air/ground communications facility, remotely controlled and providing UHF or VHF communications capability to extend the service range of an FSS.

Civil Communications Frequencies—Civil communications frequencies used in the FSS air/ground system are now operated simplex on 122.0, 122.2, 122.3, 122.4, 122.6, 123.6; emergency 121.5; plus receive-only on 122.05, 122.1, 122.15, and 123.6.

a. 122.0 is assigned as the Enroute Flight Advisory Service channel at selected FSS's.
b. 122.2 is assigned to all FSS's as a common enroute simplex service.
c. 123.6 is assigned as the airport advisory channel at non-tower FSS locations, however, it is still in commission at some FSS's collocated with towers to provide part time Airport Advisory Service.
d. 122.1 is the primary receive-only frequency at VOR's. 122.05, 122.15 and 123.6 are assigned at selected VOR's meeting certain criteria.
e. Some FSS's are assigned 50 kHz channels for simplex operation in the 122-123 MHz band (e.g. 122.35). Pilots using the FSS A/G system should refer to this directory or appropriate charts to determine frequencies available at the FSS or remoted facility through which they wish to communicate.

Part time FSS hours of operation are shown in remarks under facility name.

Emergency frequency 121.5 is available at all Flight Service Stations, Towers, Approach Control and RADAR facilities, unless indicated as not available.

Frequencies published followed by the letter "T" or "R", indicate that the facility will only transmit or receive respectively on that frequency. All radio aids to navigation frequencies are transmit only.

#### TERMINAL SERVICES

CTAF—A program designed to get all vehicles and aircraft at uncontrolled airports on a common frequency.
ATIS—A continuous broadcast of recorded non-control information in selected areas of high activity.
UNICOM—A non-government air/ground radio communications facility utilized to provide general airport advisory service.
APP CON—Approach Control. The symbol ® indicates radar approach control.
TOWER—Control tower
GND CON—Ground Control
DEP CON—Departure Control. The symbol ® indicates radar departure control.
CLNC DEL—Clearance Delivery.
PRE TAXI CLNC—Pre taxi clearance
VFR ADVSY SVC—VFR Advisory Service. Service provided by Non-Radar Approach Control.
Advisory Service for VFR aircraft (upon a workload basis) ctc APP CON.
STAGE II SVC—Radar Advisory and Sequencing Service for VFR aircraft
STAGE III SVC—Radar Sequencing and Separation Service for participating VFR Aircraft within a Terminal Radar Service Area (TRSA)
ARSA—Airport Radar Service Area
TCA—Radar Sequencing and Separation Service for all aircraft in a Terminal Control Area (TCA)
TOWER, APP CON and DEP CON RADIO CALL will be the same as the airport name unless indicated otherwise.

LEGEND 15.—Directory Legend (Communications).

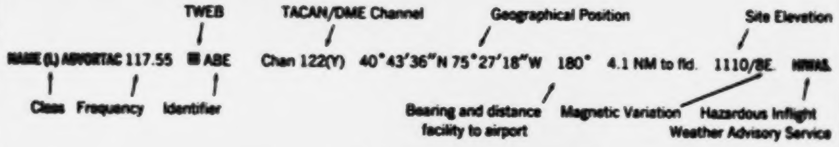
## DIRECTORY LEGEND

### RADIO AIDS TO NAVIGATION

The Airport Facility Directory lists by facility name all Radio Aids to Navigation, except Military TACANS, that appear on National Ocean Service Visual or IFR Aeronautical Charts and those upon which the FAA has approved an Instrument Approach Procedure.

All VOR, VORTAC ILS and MLS equipment in the National Airspace System has an automatic monitoring and shutdown feature in the event of malfunction. Unmonitored, as used in this publication for any navigational aid, means that FSS or tower personnel cannot observe the malfunction or shutdown signal. The NAVAID NOTAM file identifier will be shown as "NOTAM FILE IAD" and will be listed on the Radio Aids to Navigation line. When two or more NAVAIDS are listed and the NOTAM file identifier is different than shown on the Radio Aids to Navigation line, then it will be shown with the NAVAID listing. Hazardous Inflight Weather Advisory Service (HIWAS) will be shown where this service is broadcast over selected VOR's.

NAVAID information is tabulated as indicated in the following sample:


TWEB
TACAN/DME Channel
Geographical Position
Site Elevation
NAME (L) ABVORTAC 117.55 ▩ ABE Chan 122(Y) 40°43′36″N 75°27′18″W 180° 4.1 NM to fld. 1110/8E. HIWAS.
Class
Frequency
Identifier
Bearing and distance facility to airport
Magnetic Variation
Hazardous Inflight Weather Advisory Service

VOR unusable 020°-060° beyond 26 NM below 3500′

Restriction within the normal altitude/range of the navigational aid (See primary alphabetical listing for restrictions on VORTAC and VOR/DME).

Note: Those DME channel numbers with a (Y) suffix require TACAN to be placed in the "Y" mode to receive distance information.

HIWAS—Hazardous Inflight Weather Advisory Service is a continuous broadcast of inflight weather advisories including summarized SIGMETs, convective SIGMETs, AIRMETs and urgent PIREPs. HIWAS is presently broadcast over selected VOR's and will be implemented throughout the conterminous U.S.

ASR/PAR—Indicates that Surveillance (ASR) or Precision (PAR) radar instrument approach minimums are published in U.S. Government Instrument Approach Procedures.

#### RADIO CLASS DESIGNATIONS

Identification of VOR/VORTAC/TACAN Stations by Class (Operational Limitations):

Normal Usable Altitudes and Radius Distances

| Class | Altitudes | Distance (miles) |
|---|---|---|
| (T) | 12,000′ and below | 25 |
| (L) | Below 18,000′ | 40 |
| (H) | Below 18,000′ | 40 |
| (H) | Within the Conterminous 48 States only, between 14,500′ and 17,999′ | 100 |
| (H) | 18,000′ FL 450 | 130 |
| (H) | Above FL 450 | 100 |

(H) = High (L) = Low (T) = Terminal

NOTE: An (H) facility is capable of providing (L) and (T) service volume and an (L) facility additionally provides (T) service volume.

The term VOR is, operationally, a general term covering the VHF omnidirectional bearing type of facility without regard to the fact that the power, the frequency protected service volume, the equipment configuration, and operational requirements may vary between facilities at different locations.

| | |
|---|---|
| AB | Automatic Weather Broadcast (also shown with ▩ following frequency.) |
| DF | Direction Finding Service. |
| DME | UHF standard (TACAN compatible) distance measuring equipment. |
| DME(Y) | UHF standard (TACAN compatible) distance measuring equipment that require TACAN to be placed in the "Y" mode to receive DME. |
| H | Non-directional radio beacon (homing), power 50 watts to less than 2,000 watts (50 NM at all altitudes). |
| HH | Non-directional radio beacon (homing), power 2,000 watts or more (75 NM at all altitudes). |
| H-SAB | Non-directional radio beacons providing automatic transcribed weather service. |
| ILS | Instrument Landing System (voice, where available, on localizer channel). |
| ISMLS | Interim Standard Microwave Landing System. |
| LDA | Localizer Directional Aid. |

LEGEND 16.—Directory Legend (Radio Aids to Navigation).

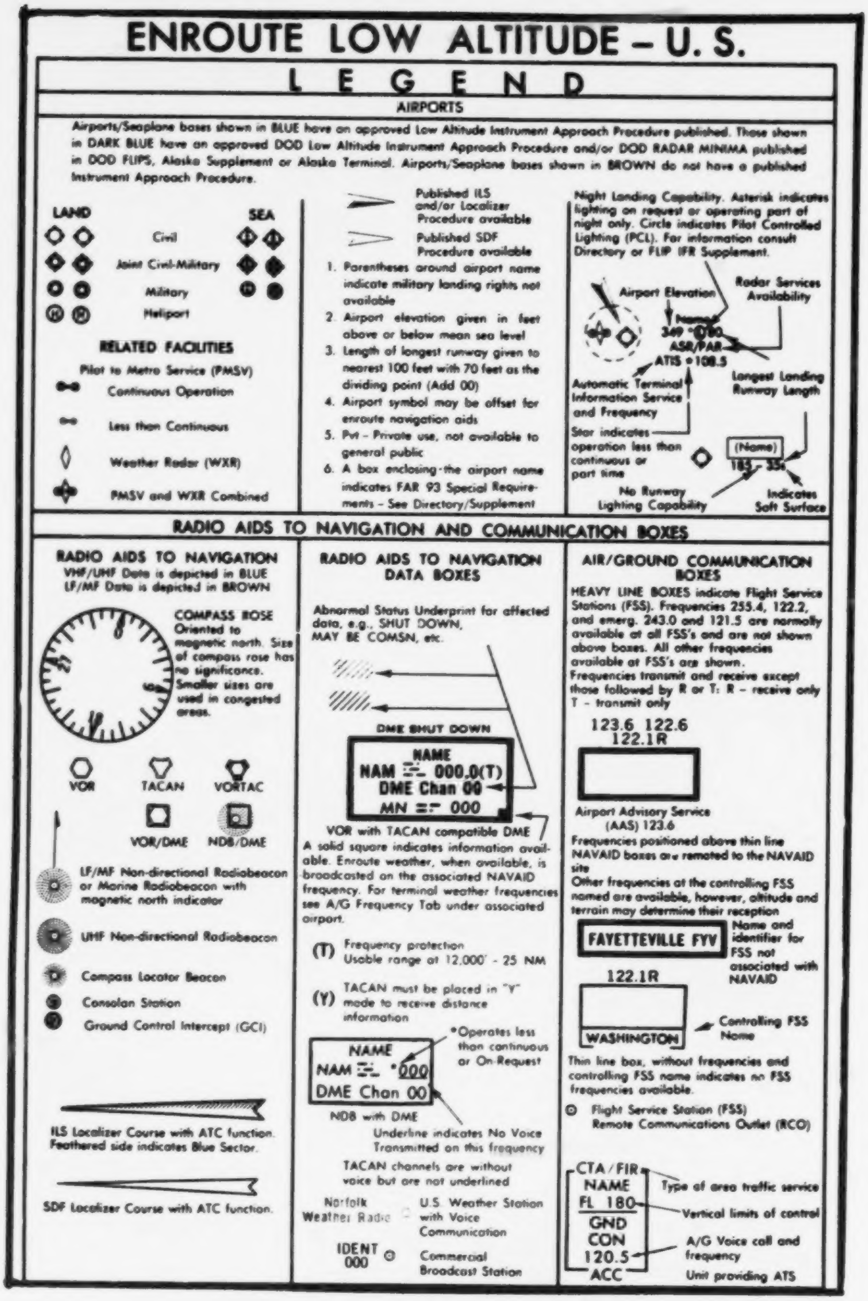
## DIRECTORY LEGEND

| | |
|---|---|
| LMM | Compass locator station when installed at middle marker site (15 NM at all altitudes). |
| LOM | Compass locator station when installed at outer marker site (15 NM at all altitudes). |
| MH | Non-directional radio beacon (homing) power less than 50 watts (25 NM at all altitudes). |
| MLS | Microwave Landing System |
| S | Simultaneous range homing signal and/or voice. |
| SABH | Non-directional radio beacon not authorized for IFR or ATC. Provides automatic weather broadcasts. |
| SDF | Simplified Direction Facility. |
| TACAN | UHF navigational facility-omnidirectional course and distance information. |
| VOR | VHF navigational facility-omnidirectional course only. |
| VOR/DME | Collocated VOR navigational facility and UHF standard distance measuring equipment. |
| VORTAC | Collocated VOR and TACAN navigational facilities. |
| W | Without voice on radio facility frequency. |
| Z | VHF station location marker at a LF radio facility. |

### FREQUENCY PAIRING PLAN AND MLS CHANNELING

| MLS CHANNEL | VHF FREQUENCY | TACAN CHANNEL | MLS CHANNEL | VHF FREQUENCY | TACAN CHANNEL | MLS CHANNEL | VHF FREQUENCY | TACAN CHANNEL |
|---|---|---|---|---|---|---|---|---|
| 500 | 108.10 | 18X | 568 | 109.45 | 31Y | 634 | 114.05 | 87Y |
| 502 | 108.30 | 20X | 570 | 109.55 | 32Y | 636 | 114.15 | 88Y |
| 504 | 108.50 | 22X | 572 | 109.65 | 33Y | 638 | 114.25 | 89Y |
| 506 | 108.70 | 24X | 574 | 109.75 | 34Y | 640 | 114.35 | 90Y |
| 508 | 108.90 | 26X | 576 | 109.85 | 35Y | 642 | 114.45 | 91Y |
| 510 | 109.10 | 28X | 578 | 109.95 | 36Y | 644 | 114.55 | 92Y |
| 512 | 109.30 | 30X | 580 | 110.05 | 37Y | 646 | 114.65 | 93Y |
| 514 | 109.50 | 32X | 582 | 110.15 | 38Y | 648 | 114.75 | 94Y |
| 516 | 109.70 | 34X | 584 | 110.25 | 39Y | 650 | 114.85 | 95Y |
| 518 | 109.90 | 36X | 586 | 110.35 | 40Y | 652 | 114.95 | 96Y |
| 520 | 110.10 | 38X | 588 | 110.45 | 41Y | 654 | 115.05 | 97Y |
| 522 | 110.30 | 40X | 590 | 110.55 | 42Y | 656 | 115.15 | 98Y |
| 524 | 110.50 | 42X | 592 | 110.65 | 43Y | 658 | 115.25 | 99Y |
| 526 | 110.70 | 44X | 594 | 110.75 | 44Y | 660 | 115.35 | 100Y |
| 528 | 110.90 | 46X | 596 | 110.85 | 45Y | 662 | 115.45 | 101Y |
| 530 | 111.10 | 48X | 598 | 110.95 | 46Y | 664 | 115.55 | 102Y |
| 532 | 111.30 | 50X | 600 | 111.05 | 47Y | 666 | 115.65 | 103Y |
| 534 | 111.50 | 52X | 602 | 111.15 | 48Y | 668 | 115.75 | 104Y |
| 536 | 111.70 | 54X | 604 | 111.25 | 49Y | 670 | 115.85 | 105Y |
| 538 | 111.90 | 56X | 606 | 111.35 | 50Y | 672 | 115.95 | 106Y |
| 540 | 108.05 | 17Y | 608 | 111.45 | 51Y | 674 | 116.05 | 107Y |
| 542 | 108.15 | 18Y | 610 | 111.55 | 52Y | 676 | 116.15 | 108Y |
| 544 | 108.25 | 19Y | 612 | 111.65 | 53Y | 678 | 116.25 | 109Y |
| 546 | 108.35 | 20Y | 614 | 111.75 | 54Y | 680 | 116.35 | 110Y |
| 548 | 108.45 | 21Y | 616 | 111.85 | 55Y | 682 | 116.45 | 111Y |
| 550 | 108.55 | 22Y | 618 | 111.95 | 56Y | 684 | 116.55 | 112Y |
| 552 | 108.65 | 23Y | 620 | 113.35 | 80Y | 686 | 116.65 | 113Y |
| 554 | 108.75 | 24Y | 622 | 113.45 | 81Y | 688 | 116.75 | 114Y |
| 556 | 108.85 | 25Y | 624 | 113.55 | 82Y | 690 | 116.85 | 115Y |
| 558 | 108.95 | 26Y | 626 | 113.65 | 83Y | 692 | 116.95 | 116Y |
| 560 | 109.05 | 27Y | 628 | 113.75 | 84Y | 694 | 117.05 | 117Y |
| 562 | 109.15 | 28Y | 630 | 113.85 | 85Y | 696 | 117.15 | 118Y |
| 564 | 109.25 | 29Y | 632 | 113.95 | 86Y | 698 | 117.25 | 119Y |
| 566 | 109.35 | 30Y | | | | | | |

LEGEND 17.—Directory Legend (Frequency Pairing Plan and MLS Channeling).



ENROUTE LOW ALTITUDE – U. S.

LEGEND

AIRPORTS

Airports/Seaplane bases shown in BLUE have an approved Low Altitude Instrument Approach Procedure published. Those shown in DARK BLUE have an approved DOD Low Altitude Instrument Approach Procedure and/or DOD RADAR MINIMA published in DOD FLIPS, Alaska Supplement or Alaska Terminal. Airports/Seaplane bases shown in BROWN do not have a published Instrument Approach Procedure.

LAND
SEA
Civil
Joint Civil-Military
Military
Heliport

RELATED FACILITIES

Pilot to Metro Service (PMSV)

Continuous Operation
Less than Continuous
Weather Radar (WXR)
PMSV and WXR Combined
Published ILS and/or Localizer Procedure available
Published SDF Procedure available

1. Parentheses around airport name indicate military landing rights not available
2. Airport elevation given in feet above or below mean sea level
3. Length of longest runway given to nearest 100 feet with 70 feet as the dividing point (Add 00)
4. Airport symbol may be offset for enroute navigation aids
5. Pvt – Private use, not available to general public
6. A box enclosing the airport name indicates FAR 93 Special Requirements – See Directory/Supplement

Night Landing Capability. Asterisk indicates lighting on request or operating part of night only. Circle indicates Pilot Controlled Lighting (PCL). For information consult Directory or FLIP IFR Supplement.

Airport Elevation
Radar Services Availability
Name
349 *(L)90
ASR/PAR
ATIS • 108.5
Automatic Terminal Information Service and Frequency
Longest Landing Runway Length
Star indicates operation less than continuous or part time
(Name)
185 - 35s
No Runway Lighting Capability
Indicates Soft Surface

RADIO AIDS TO NAVIGATION AND COMMUNICATION BOXES

RADIO AIDS TO NAVIGATION

VHF/UHF Data is depicted in BLUE
LF/MF Data is depicted in BROWN

COMPASS ROSE Oriented to magnetic north. Size of compass rose has no significance. Smaller sizes are used in congested areas.

VOR
TACAN
VORTAC
VOR/DME
NDB/DME
LF/MF Non-directional Radiobeacon or Marine Radiobeacon with magnetic north indicator
UHF Non-directional Radiobeacon
Compass Locator Beacon
Consolan Station
Ground Control Intercept (GCI)

ILS Localizer Course with ATC function. Feathered side indicates Blue Sector.

SDF Localizer Course with ATC function.

RADIO AIDS TO NAVIGATION DATA BOXES

Abnormal Status Underprint for affected data, e.g., SHUT DOWN, MAY BE COMSN, etc.

DME SHUT DOWN
NAME
NAM 000.0(T)
DME Chan 00
MN 000

VOR with TACAN compatible DME

A solid square indicates information available. Enroute weather, when available, is broadcasted on the associated NAVAID frequency. For terminal weather frequencies see A/G Frequency Tab under associated airport.

(T) Frequency protection
Usable range at 12,000' - 25 NM

(Y) TACAN must be placed in "Y" mode to receive distance information

NAME
NAM *000
DME Chan 00
*Operates less than continuous or On-Request
NDB with DME

Underline indicates No Voice Transmitted on this frequency

TACAN channels are without voice but are not underlined

Norfolk
Weather Radio
U.S. Weather Station with Voice Communication
IDENT
000
Commercial Broadcast Station

AIR/GROUND COMMUNICATION BOXES

HEAVY LINE BOXES indicate Flight Service Stations (FSS). Frequencies 255.4, 122.2, and emerg. 243.0 and 121.5 are normally available at all FSS's and are not shown above boxes. All other frequencies available at FSS's are shown.
Frequencies transmit and receive except those followed by R or T: R – receive only
T – transmit only

123.6 122.6
122.1R

Airport Advisory Service (AAS) 123.6

Frequencies positioned above thin line NAVAID boxes are remoted to the NAVAID site

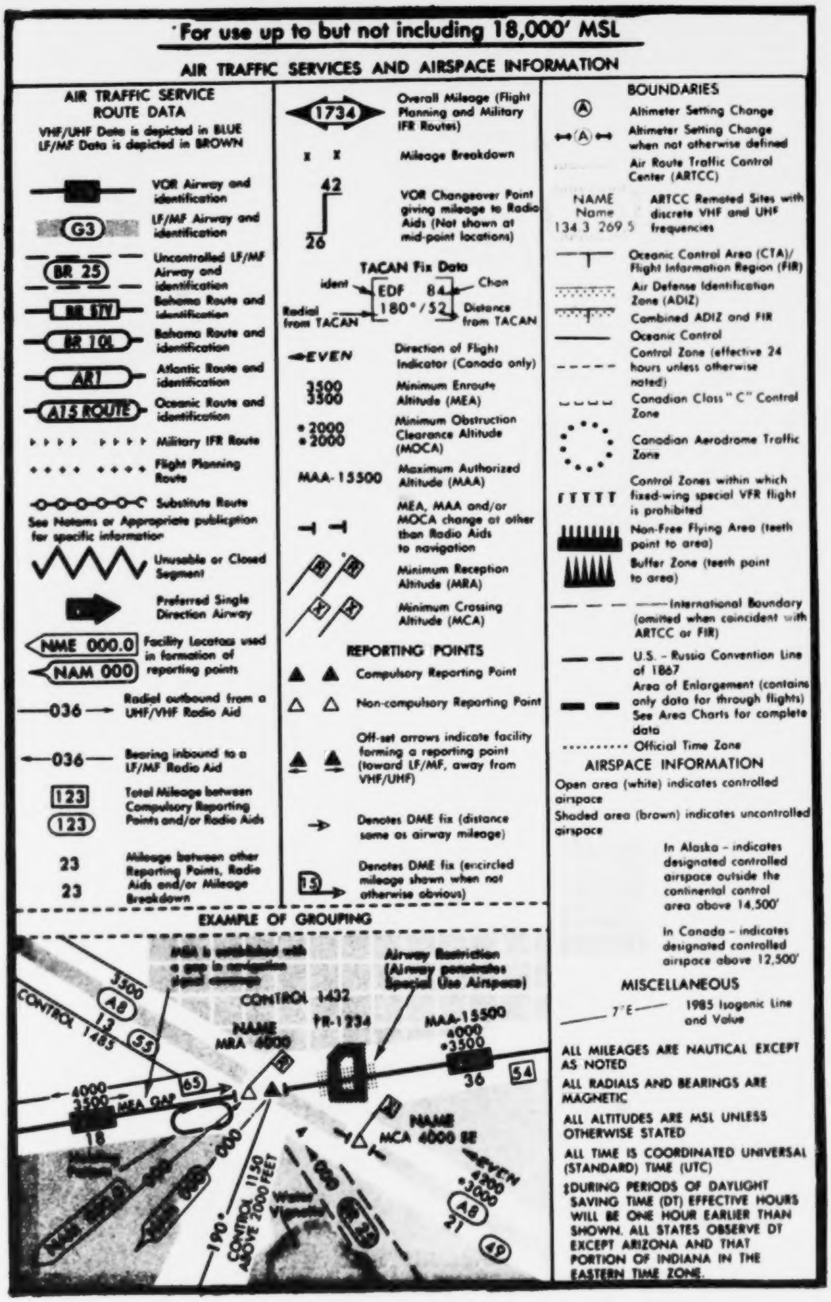
Other frequencies at the controlling FSS named are available, however, altitude and terrain may determine their reception

FAYETTEVILLE FYV
Name and identifier for FSS not associated with NAVAID
122.1R
WASHINGTON
Controlling FSS Name

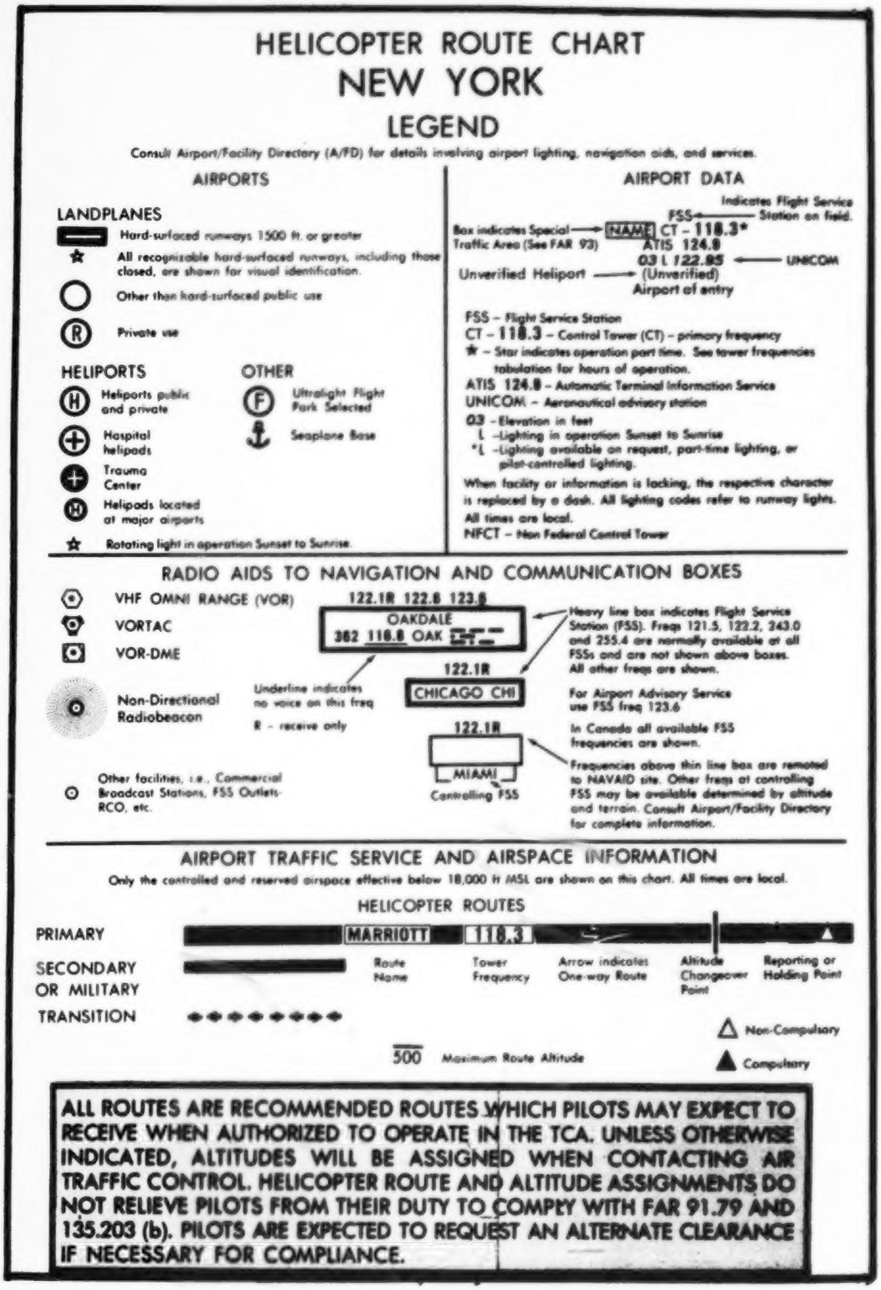
Thin line box, without frequencies and controlling FSS name indicates no FSS frequencies available.

Flight Service Station (FSS) Remote Communications Outlet (RCO)
CTA/FIR
NAME
FL 180
GND
CON
120.5
ACC
Type of area traffic service
Vertical limits of control
A/G Voice call and frequency
Unit providing ATS

LEGEND 18.—En Route Low Altitude - U.S.


For use up to but not including 18,000' MSL
AIR TRAFFIC SERVICES AND AIRSPACE INFORMATION
AIR TRAFFIC SERVICE ROUTE DATA
VHF/UHF Data is depicted in BLUE
LF/MF Data is depicted in BROWN
VOR Airway and identification
G3
LF/MF Airway and identification
BR 25
Uncontrolled LF/MF Airway and identification
BR 57V
Bahama Route and identification
BR 10L
Bahama Route and identification
AR1
Atlantic Route and identification
A15 ROUTE
Oceanic Route and identification
Military IFR Route
Flight Planning Route
Substitute Route
See Notams or Appropriate publication for specific information
Unusable or Closed Segment
Preferred Single Direction Airway
NME 000.0
NAM 000
Facility Locators used in formation of reporting points
036
Radial outbound from a UHF/VHF Radio Aid
036
Bearing inbound to a LF/MF Radio Aid
123
123
Total Mileage between Compulsory Reporting Points and/or Radio Aids
23
23
Mileage between other Reporting Points, Radio Aids and/or Mileage Breakdown
1734
Overall Mileage (Flight Planning and Military IFR Routes)
Mileage Breakdown
42
26
VOR Changeover Point giving mileage to Radio Aids (Not shown at mid-point locations)
TACAN Fix Data
Ident
EDF 84
Chan
Radial from TACAN
180°/52
Distance from TACAN
EVEN
Direction of Flight Indicator (Canada only)
3500
3500
Minimum Enroute Altitude (MEA)
•2000
•2000
Minimum Obstruction Clearance Altitude (MOCA)
MAA-15500
Maximum Authorized Altitude (MAA)
MEA, MAA and/or MOCA change at other than Radio Aids to navigation
Minimum Reception Altitude (MRA)
Minimum Crossing Altitude (MCA)
REPORTING POINTS
Compulsory Reporting Point
Non-compulsory Reporting Point
Off-set arrows indicate facility forming a reporting point (toward LF/MF, away from VHF/UHF)
Denotes DME fix (distance same as airway mileage)
15
Denotes DME fix (encircled mileage shown when not otherwise obvious)
BOUNDARIES
A
Altimeter Setting Change
A
Altimeter Setting Change when not otherwise defined
Air Route Traffic Control Center (ARTCC)
NAME
Name
134.3 269.5
ARTCC Remoted Sites with discrete VHF and UHF frequencies
Oceanic Control Area (CTA)/Flight Information Region (FIR)
Air Defense Identification Zone (ADIZ)
Combined ADIZ and FIR
Oceanic Control
Control Zone (effective 24 hours unless otherwise noted)
Canadian Class "C" Control Zone
Canadian Aerodrome Traffic Zone
Control Zones within which fixed-wing special VFR flight is prohibited
Non-Free Flying Area (teeth point to area)
Buffer Zone (teeth point to area)
International Boundary (omitted when coincident with ARTCC or FIR)
U.S. - Russia Convention Line of 1867
Area of Enlargement (contains only data for through flights) See Area Charts for complete data
Official Time Zone
AIRSPACE INFORMATION
Open area (white) indicates controlled airspace
Shaded area (brown) indicates uncontrolled airspace
In Alaska - indicates designated controlled airspace outside the continental control area above 14,500'
In Canada - indicates designated controlled airspace above 12,500'
MISCELLANEOUS
7°E
1985 Isogonic Line and Value
ALL MILEAGES ARE NAUTICAL EXCEPT AS NOTED
ALL RADIALS AND BEARINGS ARE MAGNETIC
ALL ALTITUDES ARE MSL UNLESS OTHERWISE STATED
ALL TIME IS COORDINATED UNIVERSAL (STANDARD) TIME (UTC)
‡DURING PERIODS OF DAYLIGHT SAVING TIME (DT) EFFECTIVE HOURS WILL BE ONE HOUR EARLIER THAN SHOWN. ALL STATES OBSERVE DT EXCEPT ARIZONA AND THAT PORTION OF INDIANA IN THE EASTERN TIME ZONE.
EXAMPLE OF GROUPING
MEA is established with a gap in navigation signal coverage
Airway Restriction (Airway penetrates Special Use Airspace)
CONTROL 1432
3500
A8
13
CONTROL 1485
55
NAME
MRA 4000
R-1234
MAA-15500
4000
•3500
54
36
4000
3500
MEA GAP
63
18
NAME
MCA 4000 SE
EVEN
4500
•3000
A8
21
49
190°
CONTROL 1150 ABOVE 2000 FEET
000
Water

LEGEND 19.—Air Traffic Services and Airspace Information.



## HELICOPTER ROUTE CHART
## NEW YORK
## LEGEND

Consult Airport/Facility Directory (A/FD) for details involving airport lighting, navigation aids, and services.

### AIRPORTS

**LANDPLANES**

- ▬ Hard-surfaced runways 1500 ft. or greater
- ☆ All recognizable hard-surfaced runways, including those closed, are shown for visual identification.
- ○ Other than hard-surfaced public use
- Ⓡ Private use

**HELIPORTS**

- Ⓗ Heliports public and private
- ⊕ Hospital helipads
- ⊕ Trauma Center
- Ⓗ Helipads located at major airports
- ☆ Rotating light in operation Sunset to Sunrise.

**OTHER**

- Ⓕ Ultralight Flight Park Selected
- ⚓ Seaplane Base

### AIRPORT DATA

Indicates Flight Service Station on field.
FSS
Box indicates Special Traffic Area (See FAR 93)
NAME CT - 118.3*
ATIS 124.9
03 L 122.95
UNICOM
Unverified Heliport
(Unverified)
Airport of entry

FSS – Flight Service Station
CT – 118.3 – Control Tower (CT) – primary frequency
★ – Star indicates operation part time. See tower frequencies tabulation for hours of operation.
ATIS 124.9 – Automatic Terminal Information Service
UNICOM – Aeronautical advisory station
03 – Elevation in feet
L – Lighting in operation Sunset to Sunrise
*L – Lighting available on request, part-time lighting, or pilot-controlled lighting.

When facility or information is lacking, the respective character is replaced by a dash. All lighting codes refer to runway lights.
All times are local.
NFCT – Non Federal Control Tower

### RADIO AIDS TO NAVIGATION AND COMMUNICATION BOXES

- VHF OMNI RANGE (VOR)
- VORTAC
- VOR-DME
- Non-Directional Radiobeacon
- Other facilities, i.e., Commercial Broadcast Stations, FSS Outlets-RCO, etc.

122.1R 122.6 123.6
OAKDALE
382 116.8 OAK
122.1R
CHICAGO CHI
122.1R
MIAMI
Controlling FSS

Underline indicates no voice on this freq
R – receive only

Heavy line box indicates Flight Service Station (FSS). Freqs 121.5, 122.2, 243.0 and 255.4 are normally available at all FSSs and are not shown above boxes. All other freqs are shown.

For Airport Advisory Service use FSS freq 123.6

In Canada all available FSS frequencies are shown.

Frequencies above thin line box are remoted to NAVAID site. Other freqs at controlling FSS may be available determined by altitude and terrain. Consult Airport/Facility Directory for complete information.

### AIRPORT TRAFFIC SERVICE AND AIRSPACE INFORMATION

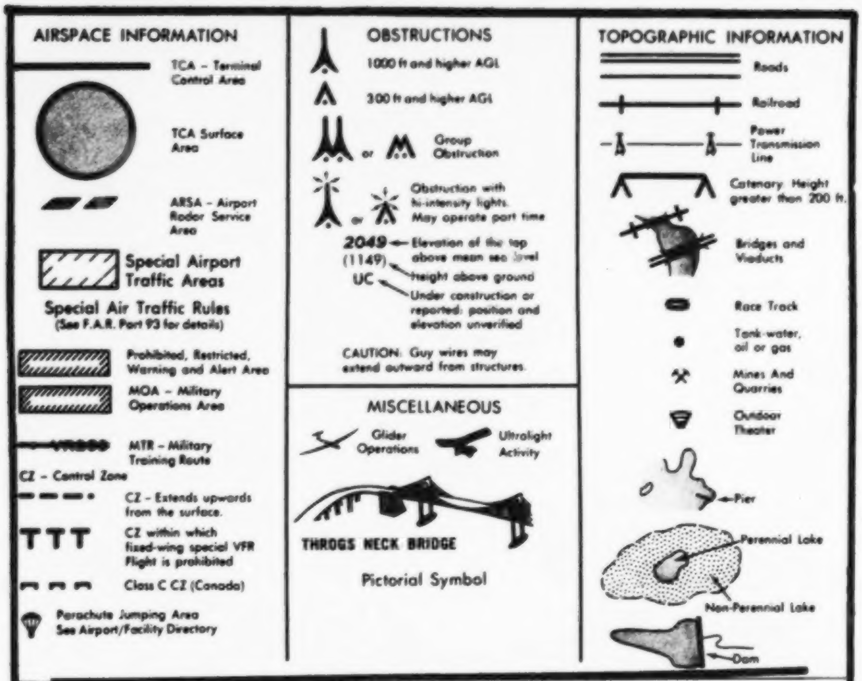
Only the controlled and reserved airspace effective below 18,000 ft MSL are shown on this chart. All times are local.

**HELICOPTER ROUTES**

PRIMARY
SECONDARY OR MILITARY
TRANSITION
MARRIOTT
118.3
Route Name
Tower Frequency
Arrow indicates One-way Route
Altitude Changeover Point
Reporting or Holding Point
△ Non-Compulsory
▲ Compulsory
500 Maximum Route Altitude

**ALL ROUTES ARE RECOMMENDED ROUTES WHICH PILOTS MAY EXPECT TO RECEIVE WHEN AUTHORIZED TO OPERATE IN THE TCA. UNLESS OTHERWISE INDICATED, ALTITUDES WILL BE ASSIGNED WHEN CONTACTING AIR TRAFFIC CONTROL. HELICOPTER ROUTE AND ALTITUDE ASSIGNMENTS DO NOT RELIEVE PILOTS FROM THEIR DUTY TO COMPLY WITH FAR 91.79 AND 135.203 (b). PILOTS ARE EXPECTED TO REQUEST AN ALTERNATE CLEARANCE IF NECESSARY FOR COMPLIANCE.**

LEGEND 20.—Helicopter Route Chart.


AIRSPACE INFORMATION
TCA – Terminal Control Area
TCA Surface Area
ARSA – Airport Radar Service Area
Special Airport Traffic Areas
Special Air Traffic Rules
(See F.A.R. Part 93 for details)
Prohibited, Restricted, Warning and Alert Area
MOA – Military Operations Area
MTR – Military Training Route
CZ – Control Zone
CZ – Extends upwards from the surface.
TTT
CZ within which fixed-wing special VFR Flight is prohibited
Class C CZ (Canada)
Parachute Jumping Area See Airport/Facility Directory
OBSTRUCTIONS
1000 ft and higher AGL
300 ft and higher AGL
or
Group Obstruction
or
Obstruction with hi-intensity lights. May operate part time
2049
Elevation of the top above mean sea level
(1149)
Height above ground
UC
Under construction or reported: position and elevation unverified
CAUTION: Guy wires may extend outward from structures.
MISCELLANEOUS
Glider Operations
Ultralight Activity
THROGS NECK BRIDGE
Pictorial Symbol
TOPOGRAPHIC INFORMATION
Roads
Railroad
Power Transmission Line
Catenary Height greater than 200 ft.
Bridges and Viaducts
Race Track
Tank-water, oil or gas
Mines And Quarries
Outdoor Theater
Pier
Perennial Lake
Non-Perennial Lake
Dam

## TERMINAL CONTROL AREA ALTITUDES

$\underline{70}$ – –Ceiling of TCA in hundreds of feet MSL

+10 – –Floor of TCA in hundreds of feet MSL

(Floors extending "upward from above" a certain altitude are preceded by a +. Operation at and below these altitudes are outside of TCA).

ATTENTION

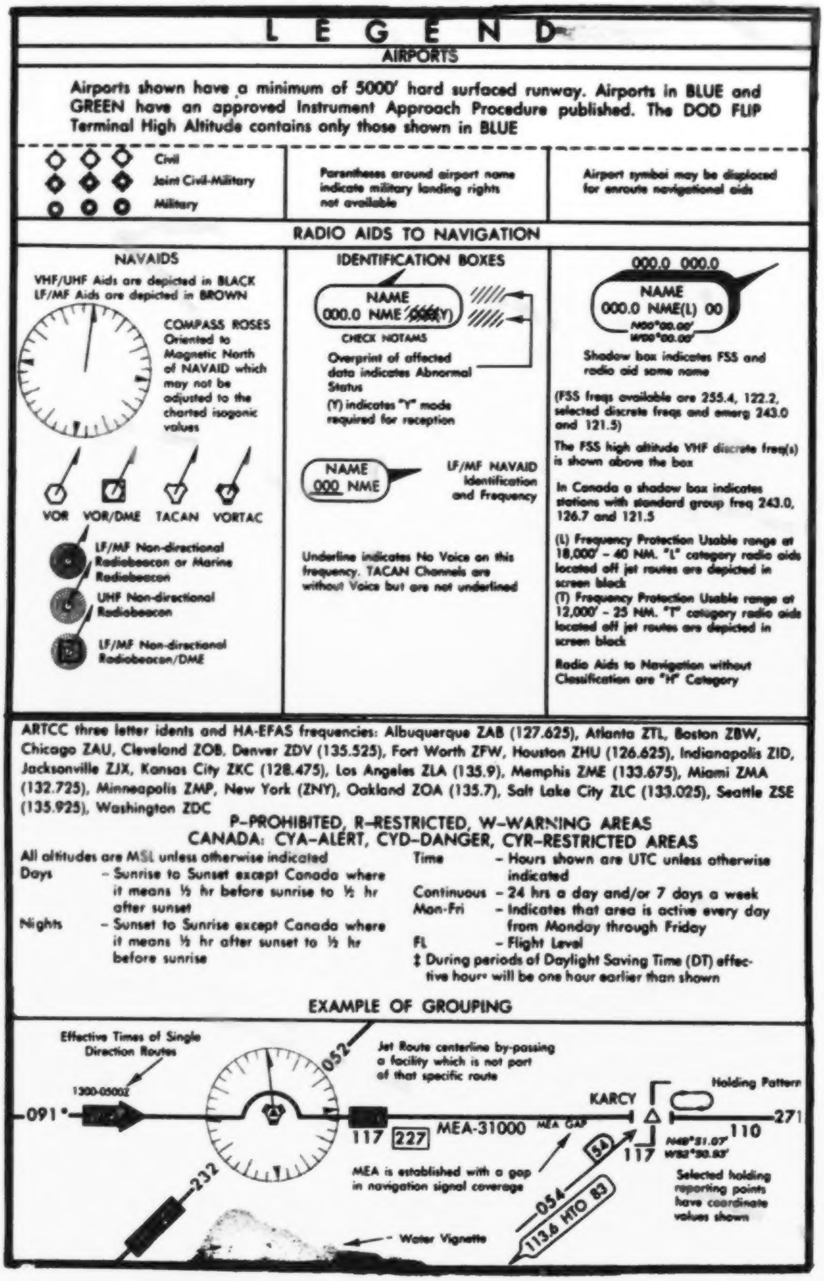
THIS CHART CONTAINS MAXIMUM ELEVATION FIGURES (MEF). The Maximum Elevation Figures shown in quadrangles bounded by ticked lines of latitude and longitude are represented in THOUSANDS and HUNDREDS of feet above mean sea level. The MEF is based on information available concerning the highest known feature in each quadrangle, including terrain and obstructions (trees, towers, antennas, etc.).

Example: 12,500 feet .............................. $12^{5}$

NOTICE TO USERS OF THIS CHART

You are urgently requested to inform us of corrections and additions that come to your attention while using this chart. Postage-paid Chart Correction cards are available at authorized chart sales agents and at FAA Flight Service Stations. Where delineation of data is required, such information should be indicated clearly and accurately on a current chart (a replacement copy will be returned). Mail to: National Ocean Service, NOAA, N/CG31, 6010 Executive Blvd., Rockville, MD 20852 or call toll-free 800-626-3677.

LEGEND 21.—Helicopter Route Chart.



LEGEND

AIRPORTS

Airports shown have a minimum of 5000′ hard surfaced runway. Airports in BLUE and GREEN have an approved Instrument Approach Procedure published. The DOD FLIP Terminal High Altitude contains only those shown in BLUE

Parentheses around airport name indicate military landing rights not available

Airport symbol may be displaced for enroute navigational aids

RADIO AIDS TO NAVIGATION

NAVAIDS

VHF/UHF Aids are depicted in BLACK
LF/MF Aids are depicted in BROWN

COMPASS ROSES Oriented to Magnetic North of NAVAID which may not be adjusted to the charted isogonic values

IDENTIFICATION BOXES

Overprint of affected data indicates Abnormal Status

(Y) indicates "Y" mode required for reception

LF/MF NAVAID Identification and Frequency

Underline indicates No Voice on this frequency. TACAN Channels are without Voice but are not underlined

Shadow box indicates FSS and radio aid same name

(FSS freqs available are 255.4, 122.2, selected discrete freqs and emerg 243.0 and 121.5)

The FSS high altitude VHF discrete freq(s) is shown above the box

In Canada a shadow box indicates stations with standard group freq 243.0, 126.7 and 121.5

(L) Frequency Protection Usable range at 18,000′ – 40 NM. "L" category radio aids located off jet routes are depicted in screen black

(T) Frequency Protection Usable range at 12,000′ – 25 NM. "T" category radio aids located off jet routes are depicted in screen black

Radio Aids to Navigation without Classification are "H" Category

ARTCC three letter idents and HA-EFAS frequencies: Albuquerque ZAB (127.625), Atlanta ZTL, Boston ZBW, Chicago ZAU, Cleveland ZOB, Denver ZDV (135.525), Fort Worth ZFW, Houston ZHU (126.625), Indianapolis ZID, Jacksonville ZJX, Kansas City ZKC (128.475), Los Angeles ZLA (135.9), Memphis ZME (133.675), Miami ZMA (132.725), Minneapolis ZMP, New York (ZNY), Oakland ZOA (135.7), Salt Lake City ZLC (133.025), Seattle ZSE (135.925), Washington ZDC

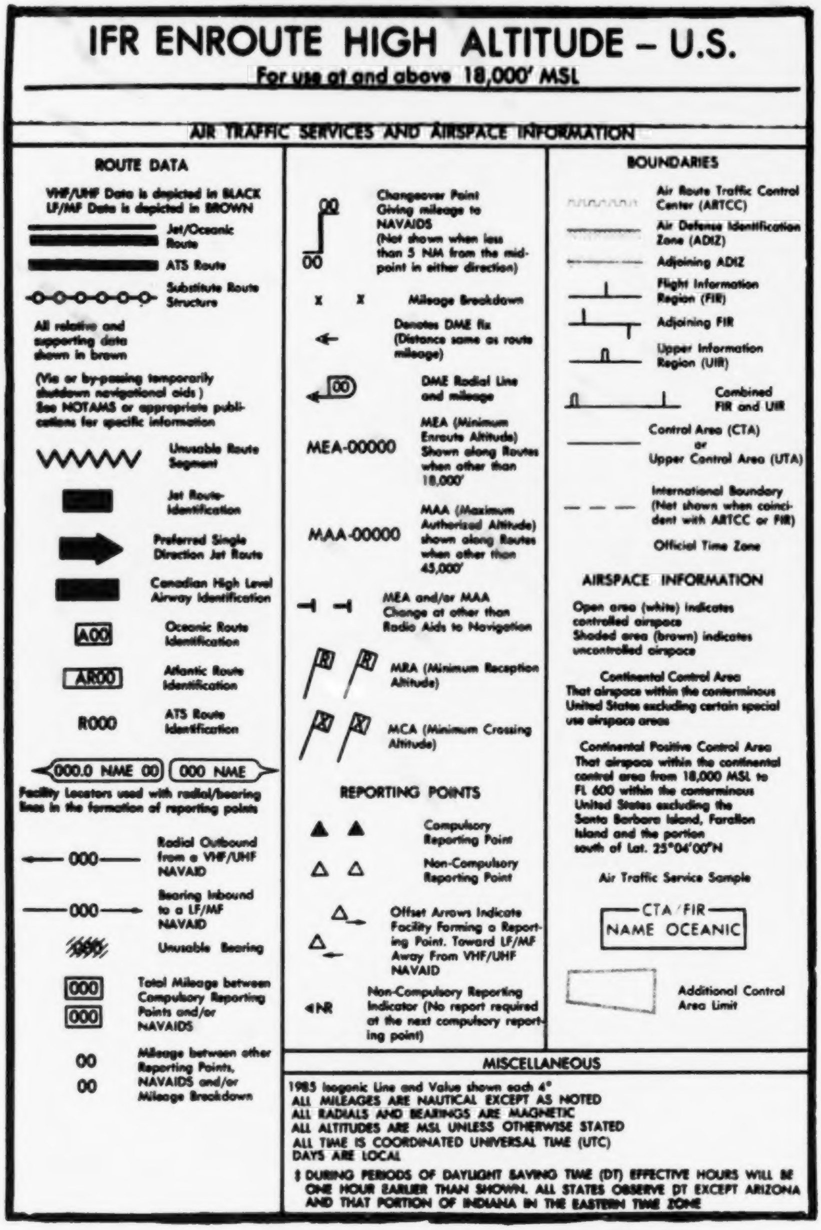
P–PROHIBITED, R–RESTRICTED, W–WARNING AREAS
CANADA: CYA–ALERT, CYD–DANGER, CYR–RESTRICTED AREAS

All altitudes are MSL unless otherwise indicated
Days – Sunrise to Sunset except Canada where it means ½ hr before sunrise to ½ hr after sunset
Nights – Sunset to Sunrise except Canada where it means ½ hr after sunset to ½ hr before sunrise
Time – Hours shown are UTC unless otherwise indicated
Continuous – 24 hrs a day and/or 7 days a week
Mon-Fri – Indicates that area is active every day from Monday through Friday
FL – Flight Level
‡ During periods of Daylight Saving Time (DT) effective hours will be one hour earlier than shown

EXAMPLE OF GROUPING

Civil
Joint Civil-Military
Military
NAME
000.0 NME (Y)
CHECK NOTAMS
NAME
000 NME
000.0 000.0
NAME
000.0 NME(L) 00
N00°00.00′
W00°00.00′
VOR
VOR/DME
TACAN
VORTAC
LF/MF Non-directional Radiobeacon or Marine Radiobeacon
UHF Non-directional Radiobeacon
LF/MF Non-directional Radiobeacon/DME
Effective Times of Single Direction Routes
1300-0500Z
Jet Route centerline by-passing a facility which is not part of that specific route
Holding Pattern
052
091°
KARCY
271
117
227
MEA-31000
MEA GAP
110
117
N48°51.07′
W82°50.83′
MEA is established with a gap in navigation signal coverage
54
054
113.6 HTO 83
Selected holding reporting points have coordinate values shown
232
Water Vignette

LEGEND 22.—Airports.


IFR ENROUTE HIGH ALTITUDE – U.S.
For use at and above 18,000′ MSL
AIR TRAFFIC SERVICES AND AIRSPACE INFORMATION
ROUTE DATA
VHF/UHF Data is depicted in BLACK
LF/MF Data is depicted in BROWN
Jet/Oceanic Route
ATS Route
Substitute Route Structure
All relative and supporting data shown in brown
(Via or by-passing temporarily shutdown navigational aids)
See NOTAMS or appropriate publications for specific information
Unusable Route Segment
Jet Route Identification
Preferred Single Direction Jet Route
Canadian High Level Airway Identification
A00
Oceanic Route Identification
AR00
Atlantic Route Identification
R000
ATS Route Identification
000.0 NME 00
000 NME
Facility Locators used with radial/bearing lines in the formation of reporting points
000
Radial Outbound from a VHF/UHF NAVAID
000
Bearing Inbound to a LF/MF NAVAID
000
Unusable Bearing
000
000
Total Mileage between Compulsory Reporting Points and/or NAVAIDS
00
00
Mileage between other Reporting Points, NAVAIDS and/or Mileage Breakdown
00
00
Changeover Point Giving mileage to NAVAIDS (Not shown when less than 5 NM from the mid-point in either direction)
X X
Mileage Breakdown
Denotes DME fix (Distance same as route mileage)
00
DME Radial Line and mileage
MEA-00000
MEA (Minimum Enroute Altitude) Shown along Routes when other than 18,000′
MAA-00000
MAA (Maximum Authorized Altitude) shown along Routes when other than 45,000′
MEA and/or MAA Change at other than Radio Aids to Navigation
R R
MRA (Minimum Reception Altitude)
X X
MCA (Minimum Crossing Altitude)
REPORTING POINTS
Compulsory Reporting Point
Non-Compulsory Reporting Point
Offset Arrows Indicate Facility Forming a Reporting Point. Toward LF/MF Away From VHF/UHF NAVAID
NR
Non-Compulsory Reporting Indicator (No report required at the next compulsory reporting point)
BOUNDARIES
Air Route Traffic Control Center (ARTCC)
Air Defense Identification Zone (ADIZ)
Adjoining ADIZ
Flight Information Region (FIR)
Adjoining FIR
Upper Information Region (UIR)
Combined FIR and UIR
Control Area (CTA) or Upper Control Area (UTA)
International Boundary (Not shown when coincident with ARTCC or FIR)
Official Time Zone
AIRSPACE INFORMATION
Air Traffic Service Sample
CTA / FIR
NAME OCEANIC
Additional Control Area Limit
MISCELLANEOUS

Open area (white) indicates controlled airspace
Shaded area (brown) indicates uncontrolled airspace

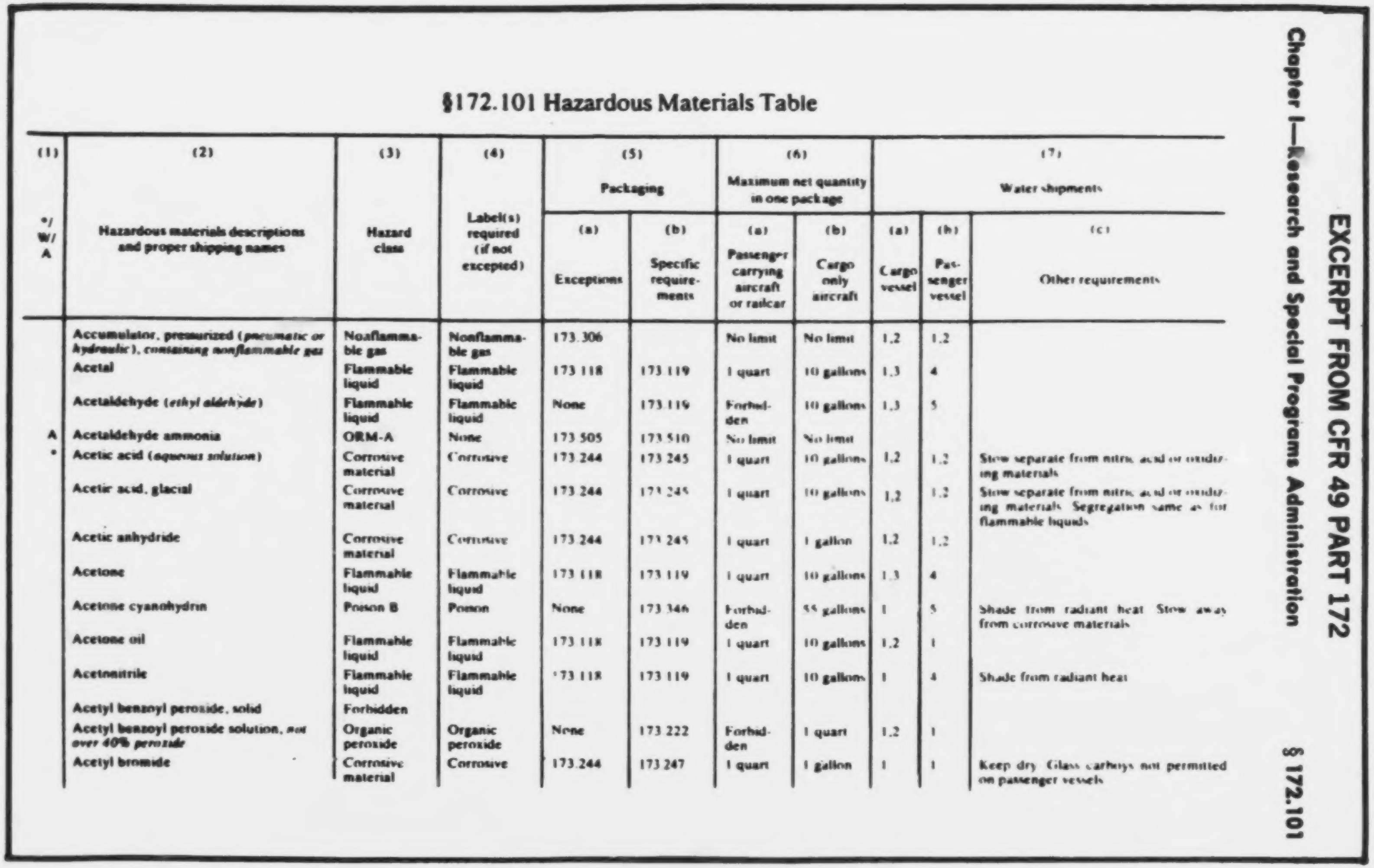
Continental Control Area
That airspace within the conterminous United States excluding certain special use airspace areas

Continental Positive Control Area
That airspace within the continental control area from 18,000 MSL to FL 600 within the conterminous United States excluding the Santa Barbara Island, Farallon Island and the portion south of Lat. 25°04′00″N

1985 Isogonic Line and Value shown each 4°
ALL MILEAGES ARE NAUTICAL EXCEPT AS NOTED
ALL RADIALS AND BEARINGS ARE MAGNETIC
ALL ALTITUDES ARE MSL UNLESS OTHERWISE STATED
ALL TIME IS COORDINATED UNIVERSAL TIME (UTC)
DAYS ARE LOCAL

‡ DURING PERIODS OF DAYLIGHT SAVING TIME (DT) EFFECTIVE HOURS WILL BE ONE HOUR EARLIER THAN SHOWN. ALL STATES OBSERVE DT EXCEPT ARIZONA AND THAT PORTION OF INDIANA IN THE EASTERN TIME ZONE

LEGEND 23.—IFR En Route High Altitude Chart.



EXCERPT FROM CFR 49 PART 172

Chapter I—Research and Special Programs Administration

§ 172.101

## §172.101 Hazardous Materials Table

| (1) | (2) | (3) | (4) | (5) | | (6) | | (7) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Packaging | | Maximum net quantity in one package | | Water shipments | | |
| */ W/ A | Hazardous materials descriptions and proper shipping names | Hazard class | Label(s) required (if not excepted) | (a) Exceptions | (b) Specific requirements | (a) Passenger carrying aircraft or railcar | (b) Cargo only aircraft | (a) Cargo vessel | (b) Passenger vessel | (c) Other requirements |
| | Accumulator, pressurized (*pneumatic or hydraulic*), *containing nonflammable gas* | Nonflammable gas | Nonflammable gas | 173.306 | | No limit | No limit | 1,2 | 1,2 | |
| | Acetal | Flammable liquid | Flammable liquid | 173.118 | 173.119 | 1 quart | 10 gallons | 1,3 | 4 | |
| | Acetaldehyde (*ethyl aldehyde*) | Flammable liquid | Flammable liquid | None | 173.119 | Forbidden | 10 gallons | 1,3 | 5 | |
| A | Acetaldehyde ammonia | ORM-A | None | 173.505 | 173.510 | No limit | No limit | | | |
| * | Acetic acid (*aqueous solution*) | Corrosive material | Corrosive | 173.244 | 173.245 | 1 quart | 10 gallons | 1,2 | 1,2 | Stow separate from nitric acid or oxidizing materials |
| | Acetic acid, glacial | Corrosive material | Corrosive | 173.244 | 173.245 | 1 quart | 10 gallons | 1,2 | 1,2 | Stow separate from nitric acid or oxidizing materials. Segregation same as for flammable liquids |
| | Acetic anhydride | Corrosive material | Corrosive | 173.244 | 173.245 | 1 quart | 1 gallon | 1,2 | 1,2 | |
| | Acetone | Flammable liquid | Flammable liquid | 173.118 | 173.119 | 1 quart | 10 gallons | 1,3 | 4 | |
| | Acetone cyanohydrin | Poison B | Poison | None | 173.346 | Forbidden | 55 gallons | 1 | 5 | Shade from radiant heat. Stow away from corrosive materials |
| | Acetone oil | Flammable liquid | Flammable liquid | 173.118 | 173.119 | 1 quart | 10 gallons | 1,2 | 1 | |
| | Acetonitrile | Flammable liquid | Flammable liquid | 173.118 | 173.119 | 1 quart | 10 gallons | 1 | 4 | Shade from radiant heat |
| | Acetyl benzoyl peroxide, solid | Forbidden | | | | | | | | |
| | Acetyl benzoyl peroxide solution, *not over 40% peroxide* | Organic peroxide | Organic peroxide | None | 173.222 | Forbidden | 1 quart | 1,2 | 1 | |
| | Acetyl bromide | Corrosive material | Corrosive | 173.244 | 173.247 | 1 quart | 1 gallon | 1 | 1 | Keep dry. Glass carboys not permitted on passenger vessels |

LEGEND 24.—Hazardous Materials Table (CFR 49 Part 172).

## §172.101 Hazardous Materials Table (cont'd)

| (1) | (2) | (3) | (4) | (5) Packaging | | (6) Maximum net quantity in one package | | (7) Water shipments | | |
|---|---|---|---|---|---|---|---|---|---|---|
| */ W/ A | Hazardous materials descriptions and proper shipping names | Hazard class | Label(s) required (if not excepted) | (a) Exceptions | (b) Specific requirements | (a) Passenger carrying aircraft or railcar | (b) Cargo only aircraft | (a) Cargo vessel | (b) Passenger vessel | (c) Other requirements |
| | Acetyl chloride | Flammable liquid | Flammable liquid | 173.244 | 173.247 | 1 quart | 1 gallon | 1 | 1 | Stow away from alcohols. Keep cool and dry. Separate longitudinally by an intervening complete compartment or hold from explosives |
| | Acetylene | Flammable gas | Flammable gas | None | 173.303 | Forbidden | 300 pounds | 1 | 1 | Shade from radiant heat |
| A | Acetylene tetrabromide | ORM-A | None | 173.505 | 173.510 | 10 gallons | 55 gallons | | | |
| | Acetyl iodide | Corrosive material | Corrosive | 173.244 | 173.247 | 1 quart | 1 gallon | 1 | 1 | Keep dry. Glass carboys not permitted on passenger vessels |
| | Acetyl peroxide solution, *not over 25% peroxide* | Organic peroxide | Organic peroxide | 173.153 | 173.222 | Forbidden | 1 quart | 1,2 | 1 | |
| | Acid butyl phosphate | Corrosive material | Corrosive | 173.244 | 173.245 | 1 quart | 5 gallons | 1,2 | 1,2 | Glass carboys in hampers not permitted under deck |
| | Acid carboy empty. *See* Carboy, empty | | | | | | | | | |
| * | Acid, liquid, n.o.s. | Corrosive material | Corrosive | 173.244 | 173.245 | 1 quart | 5 pints | 1 | 4 | Keep cool |
| * | Acid, sludge | Corrosive material | Corrosive | None | 173.248 | Forbidden | 1 quart | 1,2 | 1 | |
| | Acrolein, inhibited | Flammable liquid | Flammable liquid and Poison | None | 173.122 | Forbidden | 1 quart | 1,2 | 5 | Keep cool. Stow away from living quarters |
| | Acrylic acid | Corrosive material | Corrosive | 173.244 | 173.245 | 1 quart | 5 pints | 1 | 1 | |
| | Acrylonitrile | Flammable liquid | Flammable liquid and Poison | None | 173.119 | Forbidden | 1 quart | 1,2 | 5 | Keep cool |

LEGEND 25.—Hazardous Materials Table (CFR 49 Part 172) (Cont'd).

## §172.101 Hazardous Materials Table (cont'd)

| (1) | (2) | (3) | (4) | (5) | | (6) | | (7) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Packaging | | Maximum net quantity in one package | | Water shipments | | |
| */ W/ A | Hazardous materials descriptions and proper shipping names | Hazard class | Label(s) required (if not excepted) | (a) Exceptions | (b) Specific requirements | (a) Passenger carrying aircraft or railcar | (b) Cargo only aircraft | (a) Cargo vessel | (b) Passenger vessel | (c) Other requirements |
| | *Alkyl aluminum halides See* Pyrophoric liquid, n.o.s. | | | | | | | | | |
| A | Allethrin | ORM-A | None | 173.505 | 173.510 | No limit | No limit | | | |
| | Allyl alcohol | Flammable liquid | Flammable liquid and Poison | 173.118 | 173.119 | 1 quart | 10 gallons | 1,2 | 1 | |
| | Allyl bromide | Flammable liquid | Flammable liquid | 173.118 | 173.119 | Forbidden | 10 gallons | 1,2 | 1 | |
| | Allyl chloride | Flammable liquid | Flammable liquid | None | 173.119 | Forbidden | 10 gallons | 1,3 | 5 | |
| | Allyl chlorocarbonate | Flammable liquid | Flammable liquid | None | 173.288 | Forbidden | 5 pints | 1 | 5 | Keep dry. Separate longitudinally by an intervening complete hold or compartment from explosives. Segregation same as for corrosive materials |
| | Allyl chloroformate. *See* Allyl chlorocarbonate | | | | | | | | | |
| | Allyl trichlorosilane | Corrosive material | Corrosive | None | 173.280 | Forbidden | 10 gallons | 1 | 1 | Keep dry |
| | Aluminum alkyls. *See* Pyrophoric liquid, n.o.s. | | | | | | | | | |
| | Aluminum bromide, anhydrous | Corrosive material | Corrosive | 173.244 | 173.245b | 25 pounds | 100 pounds | 1,2 | 1,2 | Keep dry |
| | Aluminum dross, wet *or* hot. *See* Sec. 173.173 | | | | | | | | | |
| | Aluminum hydride | Flammable solid | Flammable solid and Dangerous when wet | None | 173.206 | Forbidden | 25 pounds | 1,2 | 5 | Segregation same as for flammable solid labeled Dangerous When Wet |

LEGEND 26.—Hazardous Materials Table (CFR 49 Part 172) (Cont'd).

# EXCERPT FROM CFR 49 PART 175

## PART 175—CARRIAGE BY AIRCRAFT

### Subpart A—General Information and Regulations

Sec.
175.1 Purpose and scope.
175.3 Unacceptable hazardous materials shipments.
175.5 Applicability.
175.10 Exceptions.
175.20 Compliance.
175.30 Accepting shipments.
175.33 Notification of pilot-in-command.
175.35 Shipping papers aboard aircraft.
175.40 Keeping and replacement of labels.
175.45 Reporting hazardous materials dents.

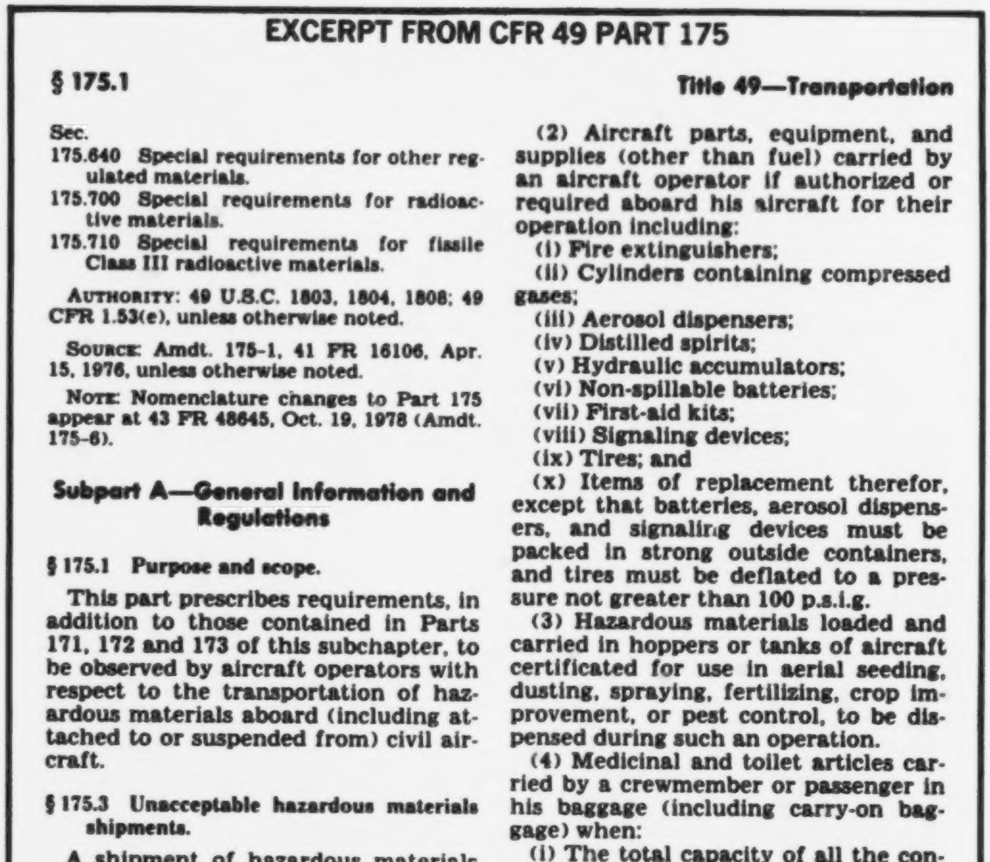
### Subpart B—Loading, Unloading and Handling

175.75 Quantity limitations aboard aircraft.
175.78 Stowage compatibility of cargo.
175.79 Orientation of cargo.
175.85 Cargo location.
175.90 Damaged shipments.

### Subpart C—Specific Regulations Applicable According to Classification of Material

175.305 Self-propelled vehicles.
175.310 Transportation of flammable liquid fuel in small, passenger-carrying aircraft.
175.320 Cargo-only aircraft; only means of transportation.
175.630 Special requirements for poisons.

LEGEND 27.—Excerpt from CFR 49 Part 175.



## EXCERPT FROM CFR 49 PART 175

§ 175.1 Title 49—Transportation

Sec.
175.640 Special requirements for other regulated materials.
175.700 Special requirements for radioactive materials.
175.710 Special requirements for fissile Class III radioactive materials.

AUTHORITY: 49 U.S.C. 1803, 1804, 1808; 49 CFR 1.53(e), unless otherwise noted.

SOURCE: Amdt. 175-1, 41 FR 16106, Apr. 15, 1976, unless otherwise noted.

NOTE: Nomenclature changes to Part 175 appear at 43 FR 48645, Oct. 19, 1978 (Amdt. 175-6).

### Subpart A—General Information and Regulations

**§ 175.1 Purpose and scope.**

This part prescribes requirements, in addition to those contained in Parts 171, 172 and 173 of this subchapter, to be observed by aircraft operators with respect to the transportation of hazardous materials aboard (including attached to or suspended from) civil aircraft.

**§ 175.3 Unacceptable hazardous materials shipments.**

A shipment of hazardous materials that is not prepared for shipment in accordance with Parts 172 and 173 of this subchapter may not be accepted for transportation or transported aboard an aircraft.

**§ 175.5 Applicability.**

This part contains regulations pertaining to the acceptance of hazardous materials for transportation, and the loading and transportation of hazardous materials, in any civil aircraft in the United States and in civil aircraft of United States registry anywhere in air commerce, except aircraft of United States registry under lease to and operated solely by foreign nationals outside the United States.

**§ 175.10 Exceptions.**

(a) This subchapter does not apply to—

(1) Aviation fuel and oil in tanks that are in compliance with the installation provisions of 14 CFR, Chapter 1.

(2) Aircraft parts, equipment, and supplies (other than fuel) carried by an aircraft operator if authorized or required aboard his aircraft for their operation including:

(i) Fire extinguishers;

(ii) Cylinders containing compressed gases;

(iii) Aerosol dispensers;

(iv) Distilled spirits;

(v) Hydraulic accumulators;

(vi) Non-spillable batteries;

(vii) First-aid kits;

(viii) Signaling devices;

(ix) Tires; and

(x) Items of replacement therefor, except that batteries, aerosol dispensers, and signaling devices must be packed in strong outside containers, and tires must be deflated to a pressure not greater than 100 p.s.i.g.

(3) Hazardous materials loaded and carried in hoppers or tanks of aircraft certificated for use in aerial seeding, dusting, spraying, fertilizing, crop improvement, or pest control, to be dispensed during such an operation.

(4) Medicinal and toilet articles carried by a crewmember or passenger in his baggage (including carry-on baggage) when:

(i) The total capacity of all the containers used by a crewmember or passenger does not exceed 75 ounces (net weight ounces and fluid ounces);

(ii) The capacity of each container other than an aerosol container does not exceed 16 fluid ounces or 1 pound of material.

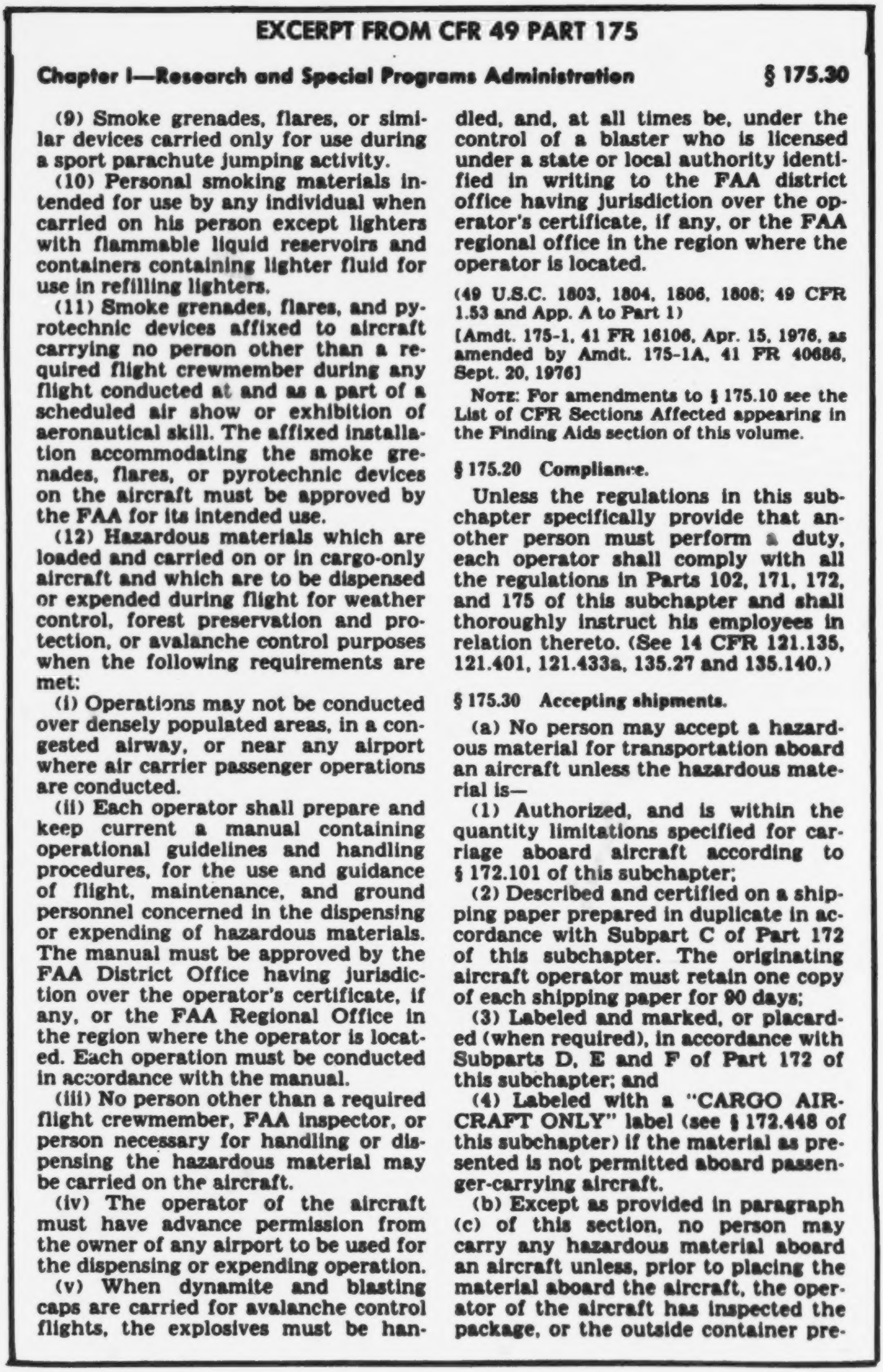
(5) Small-arms ammunition for personal use carried by a crewmember or passenger in his baggage (excluding carry-on baggage) if securely packed in fiber, wood, or metal boxes.

(6) Prior to May 3, 1981, radioactive materials which meet the requirements of § 173.391(a), (b), or (c) of this subchapter in effect on May 3, 1979.

(7) Oxygen, or any hazardous material used for the generation of oxygen, carried for medical use by a passenger in accordance with 14 CFR 121.574 or 135.114.

(8) Human beings and animals with an implanted medical device, such as a heart pacemaker, that contains radioactive material or with radio-pharmaceuticals that have been injected or ingested.

LEGEND 28.—Excerpt from CFR 49 Part 175.



## EXCERPT FROM CFR 49 PART 175

(9) Smoke grenades, flares, or similar devices carried only for use during a sport parachute jumping activity.

(10) Personal smoking materials intended for use by any individual when carried on his person except lighters with flammable liquid reservoirs and containers containing lighter fluid for use in refilling lighters.

(11) Smoke grenades, flares, and pyrotechnic devices affixed to aircraft carrying no person other than a required flight crewmember during any flight conducted at and as a part of a scheduled air show or exhibition of aeronautical skill. The affixed installation accommodating the smoke grenades, flares, or pyrotechnic devices on the aircraft must be approved by the FAA for its intended use.

(12) Hazardous materials which are loaded and carried on or in cargo-only aircraft and which are to be dispensed or expended during flight for weather control, forest preservation and protection, or avalanche control purposes when the following requirements are met:

(i) Operations may not be conducted over densely populated areas, in a congested airway, or near any airport where air carrier passenger operations are conducted.

(ii) Each operator shall prepare and keep current a manual containing operational guidelines and handling procedures, for the use and guidance of flight, maintenance, and ground personnel concerned in the dispensing or expending of hazardous materials. The manual must be approved by the FAA District Office having jurisdiction over the operator's certificate, if any, or the FAA Regional Office in the region where the operator is located. Each operation must be conducted in accordance with the manual.

(iii) No person other than a required flight crewmember, FAA inspector, or person necessary for handling or dispensing the hazardous material may be carried on the aircraft.

(iv) The operator of the aircraft must have advance permission from the owner of any airport to be used for the dispensing or expending operation.

(v) When dynamite and blasting caps are carried for avalanche control flights, the explosives must be handled, and, at all times be, under the control of a blaster who is licensed under a state or local authority identified in writing to the FAA district office having jurisdiction over the operator's certificate, if any, or the FAA regional office in the region where the operator is located.

(49 U.S.C. 1803, 1804, 1806, 1808; 49 CFR 1.53 and App. A to Part 1)

[Amdt. 175-1, 41 FR 16106, Apr. 15, 1976, as amended by Amdt. 175-1A, 41 FR 40686, Sept. 20, 1976]

NOTE: For amendments to § 175.10 see the List of CFR Sections Affected appearing in the Finding Aids section of this volume.

### § 175.20 Compliance.

Unless the regulations in this subchapter specifically provide that another person must perform a duty, each operator shall comply with all the regulations in Parts 102, 171, 172, and 175 of this subchapter and shall thoroughly instruct his employees in relation thereto. (See 14 CFR 121.135, 121.401, 121.433a, 135.27 and 135.140.)

### § 175.30 Accepting shipments.

(a) No person may accept a hazardous material for transportation aboard an aircraft unless the hazardous material is—

(1) Authorized, and is within the quantity limitations specified for carriage aboard aircraft according to § 172.101 of this subchapter;

(2) Described and certified on a shipping paper prepared in duplicate in accordance with Subpart C of Part 172 of this subchapter. The originating aircraft operator must retain one copy of each shipping paper for 90 days;

(3) Labeled and marked, or placarded (when required), in accordance with Subparts D, E and F of Part 172 of this subchapter; and

(4) Labeled with a "CARGO AIRCRAFT ONLY" label (see § 172.448 of this subchapter) if the material as presented is not permitted aboard passenger-carrying aircraft.

(b) Except as provided in paragraph (c) of this section, no person may carry any hazardous material aboard an aircraft unless, prior to placing the material aboard the aircraft, the operator of the aircraft has inspected the package, or the outside container pre-

LEGEND 29.—Excerpt from CFR 49 Part 175.

# EXCERPT FROM CFR 49 PART 175

§ 175.33 Title 49—Transportation

pared in accordance with § 173.25 of this subchapter which contains the material, and has determined that—it has no holes, leakage, or other indication that its integrity has been compromised, and for radioactive materials that the package seal has not been broken.

(c) The requirements of paragraph (b) of this section do not apply to ORM-D materials packed in a freight container and offered for transportation by one consignor.

[Amdt. 175-1, 41 FR 16106, Apr. 15, 1976, as amended by Amdt. 175-1A, 41 FR 40686, Sept. 20, 1976; Amdt. 175-1B, 41 FR 57072, Dec. 30, 1976]

**§ 175.33 Notification of pilot-in-command.**

When materials subject to the provisions of this subchapter are carried in an aircraft, the operator of the aircraft shall give the pilot-in-command the following information in writing before takeoff:

(a) The information required by §§ 172-202 and 172.203 of this subchapter;

(b) The location of the hazardous material in the aircraft; and

(c) The results of the inspection required by § 175.30(b).

[Amdt. 175-1A, 41 FR 40686, Sept. 20, 1976]

**§ 175.35 Shipping papers aboard aircraft.**

(a) A copy of the shipping papers required by § 175.30(a)(2) must accompany the shipment it covers during transportation aboard an aircraft.

(b) The documents required by paragraph (a) of this section and § 175.33 may be combined into one document if it is given to the pilot-in-command before departure of the aircraft.

**§ 175.40 Keeping and replacement of labels.**

(a) Aircraft operators who engage in the transportation of hazardous materials must keep an adequate supply of the labels specified in Subpart E of Part 172 of this subchapter, on hand at each location where shipments are loaded aboard aircraft.

(b) Lost or detached labels for packages of hazardous materials must be replaced in accordance with the information provided on the shipping papers.

**§ 175.45 Reporting hazardous materials incidents.**

(a) Each operator that transports hazardous materials shall report to the nearest Air Carrier District Office (ACDO), Flight Standards District Office (FSDO), General Aviation District Office (GADO) or other FAA facility, except that in place of reporting to the nearest of those facilities a certificate holder under 14 CFR Part 121, 127, or 135 may report to the FAA District Office holding the carrier's operating certificate and charged with overall inspection of its operations, by telephone at the earliest practicable moment after each incident that occurs during the course of transportation (including loading, unloading or temporary storage) in which as a direct result of any hazardous material—

(1) A person is killed;

(2) A person receives injuries requiring his or her hospitalization;

(3) Estimated carrier or other property damage, or both, exceeds $50,000;

(4) Fire, breakage, or spillage or suspected radioactive contamination occurs involving shipment of radioactive materials (see § 175.700(b));

(5) Fire, breakage, spillage, or suspected contamination occurs involving shipment of etiologic agents. In addition to the report required by paragraph (a) of this section, a report on an incident involving etiologic agents should be telephoned directly to the Director, Center for Disease Control, U.S. Public Health, Atlanta, Georgia, area code 404-633-5313; or

(6) A situation exists of such a nature that, in the judgment of the carrier, it should be reported to the Department even though it does not meet the criteria of paragraph (b)(1), (2), or (3) of this section, e.g., a continuing danger to life exists at the scene of the incident.

(7) If the operator conforms to the provisions of this section, the carrier requirements of § 171.15 except § 171.15(c) of this subchapter shall be deemed to have been satisfied.

(b) The following information shall be furnished in each report:

LEGEND 30.—Excerpt from CFR 49 Part 175.

## EXCERPT FROM CFR 49 PART 175

(1) Name of reporting person;

(2) Name and address of carrier represented by reporter;

(3) Phone number where reporter can be contacted;

(4) Date, time, and location of incident;

(5) The extent of the injuries, if any; and

(6) Classification, name and quantity of hazardous material involvement and whether a continuing danger to life exists at the scene.

(c) Each operator who transports hazardous materials shall report in writing, in duplicate, on DOT Form F 5800.1 within 15 days of the date of discovery, each incident that occurs during the course of transportation (including loading, unloading, or temporary storage) in which, as a direct result to hazardous materials, any of the circumstances set forth in paragraph (a) of this section occurs or there has been an unintentional release of hazardous materials from a package. Each operator making a report under this section shall send that report to the Materials Transportation Bureau, Office of Hazardous Materials Regulation, Department of Transportation, Washington, D.C. 20590, with a separate copy to the FAA facility indicated in paragraph (a) of this section.

[Amdt. 175-1, 41 FR 16106, Apr. 15, 1976, as amended by Amdt. 175-1A, 41 FR 40686, Sept. 20, 1976]

### Subpart B—Loading, Unloading and Handling

**§ 175.75 Quantity limitations aboard aircraft.**

(a) Except as provided in § 175.85(b), no person may carry on an aircraft—

(1) A hazardous material except as permitted in Part 172 of this subchapter;

(2) More than 50 pounds net weight of hazardous material (and in addition thereto, 150 pounds net weight of nonflammable compressed gas) permitted to be carried aboard passenger-carrying aircraft—

(i) In an inaccessible cargo compartment,

(ii) In any freight container within an accessible cargo compartment, or

(iii) In any accessible cargo compartment in a cargo-only aircraft in a manner that makes it inaccessible unless in a freight container;

(3) Packages containing radioactive materials when their combined transport indices exceed 50.

(b) No limitation applies to the number of packages of ORM material aboard an aircraft.

[Amdt. 175-1A, 41 FR 40686, Sept. 20, 1976]

**§ 175.78 Stowage compatibility of cargo.**

(a) No person may stow a package of a corrosive material on an aircraft next to or in a position that will allow contact with a package of flammable solids, oxidizing materials, or organic peroxides.

(b) No person may stow a package labeled BLASTING AGENT on an aircraft next to, or in a position that will allow contact with a package of special fireworks or railway torpedoes.

[Amdt. 175-1, 41 FR 16106, Apr. 15, 1976, as amended by Amdt. 175-8, 44 FR 31184, May 31, 1979]

**§ 175.79 Orientation of cargo.**

(a) A package containing hazardous materials marked "THIS SIDE UP", "THIS END UP", or with arrows to indicate the proper orientation of the package, must be stored, loaded abroad an aircraft in accordance with such markings, and secured in a manner that will prevent any movement which would change the orientation of the package.

(b) A package containing liquid hazardous materials not marked as indicated in paragraph (a) of this section must be stored and loaded with closures up.

**§ 175.85 Cargo location.**

(a) No person may carry a hazardous material subject to the requirements of this subchapter in the cabin of a passenger-carrying aircraft.

(b) Each person carrying materials acceptable only for cargo-only aircraft shall carry those materials in a location accessible to a crewmember during flight. However, when materials acceptable for cargo-only or pas-

LEGEND 31.—Excerpt from CFR 49 Part 175.

## EXCERPT FROM CFR 49 PART 175

senger carrying aircraft are carried on a small, single pilot, cargo-only aircraft being used where other means of transportation are impracticable or not available, they may be carried without quantity limitation as specified in § 175.75 in a location that is not accessible to the pilot subject to the following conditions.

(1) No person other than the pilot, an FAA inspector, the shipper or consignee of the material or a representative of the shipper or consignee so designated in writing, or a person necessary for handling the material may be carried on the aircraft.

(2) The pilot must be provided with written instructions on characteristics and proper handling of the material.

(3) Whenever a change of pilots occurs while the material is on board, the new pilot must be briefed under a hand-to-hand signature service provided by the operator of the aircraft.

(c) No person may load magnetized material (which might cause an erroneous magnetic compass reading) on an aircraft, in the vicinity of a magnetic compass, or compass master unit, that is a part of the instrument equipment of the aircraft, in a manner that affects its operation. If this requirement cannot be met, a special aircraft swing and compass calibration may be made. No person loading magnetized materials may obscure the warning labels.

(d) No person may carry materials subject to the requirements of this subchapter in an aircraft unless they are suitably safeguarded to prevent their becoming a hazard by shifting. For packages bearing "RADIOACTIVE YELLOW-II" or "RADIOACTIVE YELLOW-III" labels, such safeguarding must prevent movement that would permit the package to be closer to a space that is occupied by a person or an animal than is permitted by § 175.700.

(e) No person may carry a material subject to the requirements of this subchapter that is acceptable for carriage in a passenger-carrying aircraft (other than magnetized materials) unless it is located in the aircraft in a place that is inaccessible to persons other than crew-members.

[Amdt. 175-1, 41 FR 16106, Apr. 15, 1976, as amended by Amdt. 175-1A, 41 FR 40686, Sept. 20, 1976]

**§ 175.90 Damaged shipments.**

Except as provided for in § 175.700, the operator of an aircraft shall remove from the aircraft any package subject to this subchapter that appears to be damaged or leaking. No person shall place or transport a package that is damaged or appears to be damaged or leaking aboard an aircraft subject to this Part.

[Amdt. 175-1, 41 FR 16106, Apr. 15, 1976, as amended by Amdt. 175-1A, 41 FR 40686, Sept. 20, 1976]

### Subpart C—Specific Regulations Applicable According to Classification of Material

**§ 175.305 Self-propelled vehicles.**

(a) Self-propelled vehicles are exempt from the drainage requirements of § 173.120 of this subchapter when carried in aircraft designed or modified for vehicle ferry operations and when all of the following conditions are met:

(1) Authorization for this type operation has been given by the appropriate authority in the government of the country in which the aircraft is registered;

(2) Each vehicle is secured in an upright position;

(3) Each fuel tank is filled in a manner and only to a degree that will preclude spillage of fuel during loading, unloading, and transportation; and

(4) Ventilation rates to be maintained in the vehicle storage compartment have been approved by the appropriate authority in the government of the country in which the aircraft is registered.

**§ 175.310 Transportation of flammable liquid fuel in small, passenger-carrying aircraft.**

A small aircraft or helicopter operated entirely within the State of Alaska or into a remote area elsewhere in the United States may carry, in other than scheduled passenger operations, not more than 20 gallons of flammable liquid fuel, if—

LEGEND 32.—Excerpt from CFR 49 Part 175.

# EXCERPT FROM CFR 49 PART 175

**Chapter I—Research and Special Programs Administration** **§ 175.320**

(a) Transportation by air is the only practical means of providing suitable fuel;

(b) The flight is necessary to meet the needs of a passenger;

(c) The fuel is carried in metal containers that are either—

(1) DOT Specification 2A containers of not more than 5 gallons capacity, each packed inside a DOT Specification 12B fiberboard box or each packed inside a DOT Specification 15A, 15B, 15C, 16A, 19A or 19B wooden box, or in the case of a small aircraft in Alaska, each packed inside a wooden box of at least one-half inch thickness;

(2) Airtight, leakproof, inside containers of not more than 10 gallons capacity and of at least 28-gauge metal, each packed inside a DOT Specification 15A, 15B, 15C, 16A, 19A, or 19B wooden box or, in the case of a small aircraft in Alaska, each packed inside a wooden box of at least one-half inch thickness;

(3) DOT Specification 17E containers of not more than 5 gallons capacity; or

(4) Fuel tanks attached to flammable liquid fuel powered equipment under the following conditions:

(i) Each piece of equipment is secured in an upright position;

(ii) Each fuel tank is filled in a manner that will preclude spillage of fuel during loading, unloading, and transportation; and

(iii) Ventilation rates which are maintained in the compartment in which the equipment is carried have been approved by the FAA district office responsible for inspection and surveillance of the aircraft on which the equipment is carried.

(d) In the case of a helicopter, the fuel is carried on external cargo racks;

(e) The area or compartment in which the fuel is loaded is ventilated so as to prevent the accumulation of fumes;

(f) Before each flight, the pilot-in-command—

(1) Informs each passenger of the location of the fuel and the hazards involved; and

(2) Prohibits smoking, lighting matches, the carrying of any lighted cigar, pipe, cigarette or flame, and the use of anything that might cause an open flame or spark, while loading or unloading or in flight; and

(g) Fuel is transferred to the fuel tanks only while the aircraft is on the surface.

[Amdt. 175-1, 41 FR 16106, Apr. 15, 1976, as amended by Amdt. 175-1A, 41 FR 40686, Sept. 20, 1976]

**§ 175.320 Cargo-only aircraft; only means of transportation.**

(a) Notwithstanding § 172.101, when means of transportation other than air are impracticable or not available, hazardous materials listed in the following table may be carried on a cargo-only aircraft subject to the conditions stated in the table and in paragraph (b) of this section and, when appropriate, paragraph (c) of this section:

| Material description | Class | Conditions |
|---|---|---|
| Electric blasting caps (more than 1,000). | Class A explosives | Permitted only when no other cargo is aboard the aircraft. However, if the electric blasting caps are packed in an IME 22 container (see 49 CFR 171.7(d)(9)), they may be transported in the same aircraft with materials that are not classed as hazardous materials. |
| Electric blasting caps (1,000 or less). | Class C explosives | Permitted only when no other cargo is aboard the aircraft. However, if the electric blasting caps are packed in a DOT MC 201 container (49 CFR 178.318) or an IME 22 container (see 49 CFR 171.7(d)(9)), they may be transported in the same aircraft with materials other than class A or class B explosives. |
| Gasoline | Flammable liquid | Permitted in metal drums having rated capacities of 55 gal. or less. May not be transported in the same aircraft with materials classed as class A, B, or C explosives, blasting agents, corrosive materials or oxidizing materials. Permitted in installed tanks each having a capacity of more than 110 gal. Subject to the conditions specified in para. (c) of this section. |

LEGEND 33.—Excerpt from CFR 49 Part 175.

## EXCERPT FROM CFR 49 PART 175

**§ 175.320** **Title 49—Transportation**

| Material description | Class | Conditions |
|---|---|---|
| High explosives | Class A explosives | Limited to explosives to be used for blasting. Permitted only when no other cargo is aboard the aircraft or when being transported in the same aircraft with an authorized shipment of any 1 or more of the following materials to be used for blasting:<br>Ammonium nitrate-fuel oil mixtures Blasting agent, n.o.s.<br>Cordeau detonant fuse.<br>Propellant explosive (solid) class B (water gels only).<br>Propellant explosive (liquid) class B (water gels only). |
| Oil n.o.s.; petroleum oil or petroleum oil, n.o.s. | Flammable liquid | Permitted in metal drums having rated capacities of 55 gal. or less. May not be transported in the same aircraft with materials classed as class A, B, or C explosives, blasting agents, corrosive materials, or oxidizing materials. Permitted in installed tanks each having a capacity of more than 110 gal. subject to the conditions specified in para. (c) of this section. |
| Combustible liquid, n.o.s | Combustible liquid | Permitted in installed tanks each having a capacity of more than 110 gal subject to the conditions specified in par. (c) of this section. |

(b) The following conditions apply to the carriage of hazardous materials performed under the authority of this section:

(1) No person other than a required flight crewmember, an FAA inspector, the shipper or consignee of the material or a representative of the shipper or consignee so designated in writing, or a person necessary for handling the material may be carried on the aircraft.

(2) The operator of the aircraft must have advance permission from the owner or operator of each manned airport where the material is to be loaded or unloaded or where the aircraft is to land while the material is on board. When the destination is changed after departure because of weather or other unforeseen circumstances, permission from the owner or operator of the alternate airport should be obtained as soon as practicable before landing.

(3) At any airport where the airport owner or operator or authorized representative thereof has designated a location for loading or unloading the material concerned, the material may not be loaded or unloaded at any other location.

(4) If the material concerned can create destructive forces or have lethal or injurious effects over an appreciable area as a result of an accident involving the aircraft or the material, the loading and unloading of the aircraft and its operation in takeoff, en route, and in landing must be conducted at a safe distance from heavily populated areas and from any place of human abode or assembly.

(5) If the aircraft is being operated by a holder of a certificate issued under 14 CFR Part 121, Part 127, or Part 135, operations must be conducted in accordance with conditions and limitations specified in the certificate holder's operations specifications or operations manual accepted by the FAA. If the aircraft is being operated under 14 CFR Part 91, operations must be conducted in accordance with an operations plan accepted and acknowledged in writing by the operator's FAA District Office.

(6) Each pilot of the aircraft must be provided written instructions stating the conditions and limitations of the operation being conducted and the name of the airport official[s] granting the advance permission required by the first sentence of paragraph (b)(2) of this section.

(7) The aircraft and the loading arrangement to be used must be approved for safe carriage of the particular materials concerned by the FAA District Office holding the operator's certificate and charged with overall inspection of its operations, or the appropriate FAA District Office serving the place where the material is to be loaded.

LEGEND 34.—Excerpt from CFR 49 Part 175.

## EXCERPT FROM CFR 49 PART 175

(8) When Class A explosives are carried under the authority of this section, the operator of the aircraft shall obtain route approval from the FAA inspector in the operator's FAA District Office.

(9) During loading and unloading, no person may smoke, carry a lighted cigarette, cigar, or pipe, or operate any device capable of causing an open flame or spark within 50 feet of the aircraft.

(c) The following additional conditions apply to the carriage of flammable liquids and combustible liquids in tanks each having a capacity of more than 110 gallons under the authority of this section:

(1) The tanks and their associated piping and equipment and the installation thereof must have been approved for the material to be transported by the appropriate FAA Regional Office.

(2) In the case of an aircraft being operated by a certificate holder, the operator shall list the aircraft and the approval information in its operating specifications. If the aircraft is being operated by other than a certificate holder, a copy of the FAA Regional Office approval required by this section must be carried on the aircraft.

(3) The crew of the aircraft must be thoroughly briefed on the operation of the particular bulk tank system being used.

(4) During loading and unloading and thereafter until any remaining fumes within the aircraft are dissipated:

(i) Only those electrically operated bulk tank shutoff valves that have been approved under a supplemental type certificate may be electrically operated.

(ii) No engine or electrical equipment, avionic equipment, or auxiliary power units may be operated, except position lights in the steady position and equipment required by approved loading or unloading procedures, as set forth in the operator's operations manual, or for operators that are not certificate holders, as set forth in a written statement.

(iii) No person may fill a container, other than an approved bulk tank, with a flammable or combustible liquid or discharge a flammable or combustible liquid from a container, other than an approved bulk tank, while that container is inside or within 50 feet of the aircraft.

(iv) When filling an approved bulk tank by hose from inside the aircraft, the doors and hatches must be fully open to insure proper ventilation.

(v) Static ground wires must be connected between the storage tank or fueler and the aircraft, and between the aircraft and a positive ground device.

[Amdt. 175-1, 41 FR 16106, Apr. 15, 1976, as amended by Amdt. 175-1A, 41 FR 40686, Sept. 20, 1976]

NOTE: For amendments to § 175.320 see the List of CFR Sections Affected appearing in the Finding Aids section of this volume.

**§ 175.630 Special requirements for poisons.**

(a) No person may transport a package bearing a POISON label aboard an aircraft in the same cargo compartment with material which is marked as or known to be food stuff, feed, or any other edible material intended for consumption by humans or animals.

(b) No person may operate an aircraft that has been used to transport any package bearing a POISON label unless, upon removal of such package, the area in the aircraft in which it was carried is visually inspected for evidence of leakage, spillage, or other contamination. All contamination discovered must be either isolated or removed from the aircraft. The operation of an aircraft contaminated with such poisons is considered to be the carriage of poisonous materials under paragraph (a) of this section.

**§ 175.640 Special requirements for other regulated materials.**

Asbestos must be loaded, handled, and unloaded, and any asbestos contamination of aircraft removed, in a manner that will minimize occupational exposure to airborne asbestos particles released incident to transportation. (See § 173.1090 of this subchapter.)

[Amdt. 175-7, 43 FR 56668, Dec. 4, 1978]

**§ 175.700 Special requirements for radioactive materials.**

(a) No person may place any package of radioactive materials bearing

LEGEND 35.—Excerpt from CFR 49 Part 175.

## EXCERPT FROM CFR 49 PART 175

**§ 175.700**

**Title 49—Transportation**

"RADIOACTIVE YELLOW-II" or "RADIOACTIVE YELLOW-III" labels in an aircraft closer than the distances shown in the following table to a space (or dividing partition between spaces) which may be continuously occupied by people, or shipments of animals, or closer than the distances shown in the following table to any package containing undeveloped film (if so marked). If more than one of these packages is present, the distance shall be computed from the following table on the basis of the total transport index numbers shown on labels of the individual packages in the aircraft:

| Total transport index | Minimum separation distances in feet to the nearest undeveloped film for various times of transit | | | | | Minimum distance in feet to area of persons, or minimum distance in feet from dividing partition of cargo compartment |
|---|---|---|---|---|---|---|
| | Up to 2 hr | 2-4 hr | 4-8 hr | 8-12 hr | Over 12 hr | |
| None | 0 | 0 | 0 | 0 | 0 | 0 |
| 0.1 to 1.0 | 1 | 2 | 3 | 4 | 5 | 1 |
| 1.1 to 5.0 | 3 | 4 | 6 | 8 | 11 | 2 |
| 5.1 to 10.0 | 4 | 6 | 9 | 11 | 15 | 3 |
| 10.1 to 20.0 | 5 | 8 | 12 | 16 | 22 | 4 |
| 20.1 to 30.0 | 7 | 10 | 15 | 20 | 29 | 5 |
| 30.1 to 40.0 | 8 | 11 | 17 | 22 | 33 | 6 |
| 40.1 to 50.0 | 9 | 12 | 19 | 24 | 36 | 7 |

(b) In addition to the reporting requirements of § 175.45, the carrier must also notify the shipper at the earliest practicable moment following any incident in which there has been breakage, spillage, or suspected radioactive contamination involving radioactive materials shipments. Aircraft in which radioactive materials have been spilled may not be again placed in service or routinely occupied until the radiation does rate at any accessible surface is less than 0.5 millirem per hour and there is no significant removable radioactive surface contamination (see § 173.397 of this subchapter). In these instances, the package or materials should be segregated as far as practicable from personnel contact. If radiological advice or assistance is needed, the U.S. Energy Research and Development Administration should also be notified. In case of obvious leakage, or if it appears likely that the inside container may have been damaged, care should be taken to avoid inhalation, ingestion, or contact with the radioactive materials. Any loose radioactive materials should be left in a segregated area pending disposal instructions from qualified persons.

(c) No person may carry aboard a passenger-carrying aircraft any package of radioactive material which contains a large quantity (large radioactive source) of radioactivity (as defined in § 173.389(b) of this subchapter), except as specifically approved by the Director, Office of Hazardous Materials Regulation, Materials Transportation Bureau, Department of Transportation.

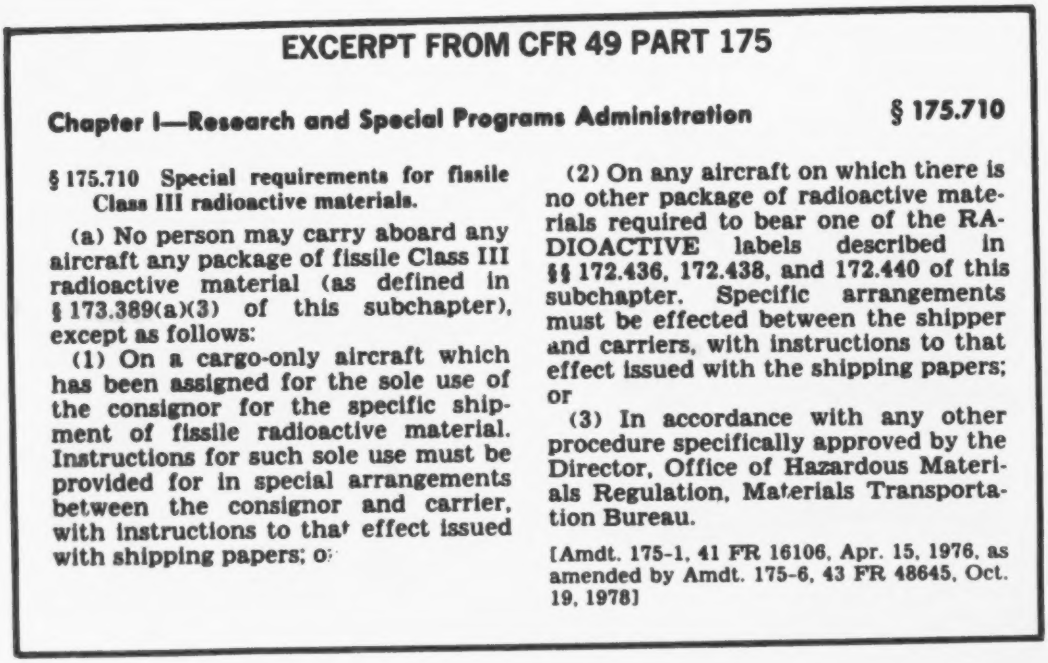
(d) Except as provided in this paragraph, no person may carry aboard a passenger-carrying aircraft any radioactive material other than a radioactive material intended for use in, or incident to, research or medical diagnosis or treatment. Prior to May 3, 1981, this prohibition does not apply to materials which meet the requirements of § 173.391(a), (b), or (c) of this subchapter in effect on May 3, 1979.

(49 U.S.C. 1803, 1804, 1806, 1808; 49 CFR 1.53 and App. A to Part 1)

[Amdt. 175-1, 41 FR 16106, Apr. 15, 1976, as amended by Amdt. 175-4, 42 FR 22367, May 3, 1977]

NOTE: For amendments to § 175.700 see the List of CFR Sections Affected appearing in the Finding Aids section of this volume.

LEGEND 36.—Excerpt from CFR 49 Part 175.



## EXCERPT FROM CFR 49 PART 175

**Chapter I—Research and Special Programs Administration** § 175.710

**§ 175.710 Special requirements for fissile Class III radioactive materials.**

(a) No person may carry aboard any aircraft any package of fissile Class III radioactive material (as defined in § 173.389(a)(3) of this subchapter), except as follows:

(1) On a cargo-only aircraft which has been assigned for the sole use of the consignor for the specific shipment of fissile radioactive material. Instructions for such sole use must be provided for in special arrangements between the consignor and carrier, with instructions to that effect issued with shipping papers; or

(2) On any aircraft on which there is no other package of radioactive materials required to bear one of the RADIOACTIVE labels described in §§ 172.436, 172.438, and 172.440 of this subchapter. Specific arrangements must be effected between the shipper and carriers, with instructions to that effect issued with the shipping papers; or

(3) In accordance with any other procedure specifically approved by the Director, Office of Hazardous Materials Regulation, Materials Transportation Bureau.

[Amdt. 175-1, 41 FR 16106, Apr. 15, 1976, as amended by Amdt. 175-6, 43 FR 48645, Oct. 19, 1978]

LEGEND 37.—Excerpt from CFR 49 Part 175.

# PIREP

(U)UA➡/OV➡ FL

MSG TYPE LOCATION OF PHENOMENA 3-LTR ·IDENT RADIAL DISTANCE TIME (Z) FLT LVL

/TP➡ /SK➡

TYPE AIRCRAFT SKY COVER BASE AMOUNT TOP

/TA➡ /WV➡

TEMPERATURE-CELSIUS WIND-DIRECTION SPEED

/TB➡ /IC➡

TURBULENCE-INTENSITY TYPE* ALTITIDE** ICING-INTENSITY TYPE ALTITUDE**

/RM➡

REMARKS (MOST HAZARDOUS ELEMENT REPORTED FIRST)

LEGEND: ➡ = SPACE SYMBOL *=ONLY FOR CAT **=ONLY IF DIFFERENT FROM FL

## TURBULENCE REPORTING CRITERIA TABLE

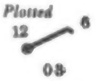
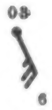
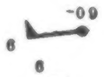
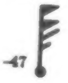
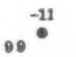
| *Intensity* | *Aircraft Reaction* | *Reaction Inside Aircraft* |
|---|---|---|
| LIGHT | Turbulence that momentarily causes slight, erratic changes in altitude and/or attitude (pitch, roll, yaw). Report as *Light Turbulence*;*<br>or<br>Turbulence that causes slight, rapid and somewhat rhythmic bumpiness without appreciable changes in altitude or attitude. Report as *Light Chop.* | Occupants may feel a slight strain against seat belts or shoulder straps. Unsecured objects may be displaced slightly. Food service may be conducted and little or no difficulty is encountered in walking. |
| MODERATE | Turbulence that is similar to Light Turbulence but of greater intensity. Changes in altitude and/or attitude occur but the aircraft remains in positive control at all times. It usually causes variations in indicated airspeed. Report as *Moderate Turbulence*;*<br>or<br>Turbulence that is similar to Light Chop but of greater intensity. It causes rapid bumps or jolts without appreciable changes in aircraft altitude or attitude. Report as *Moderate Chop.* | Occupants feel definite strains against seat belts or shoulder straps. Unsecured objects are dislodged. Food service and walking are difficult. |
| SEVERE | Turbulence that causes large, abrupt changes in ~~altitude~~ and/or attitude. It usualy causes large variations in indicated airspeed. Aircraft may be momentarily out of control. Report as *Severe Turbulence.** | Occupants are forced violently against seat belts or shoulder straps. Unsecured objects are tossed about. Food service and walking are impossible. |
| EXTREME | Turbulence in which the aircraft is violently tossed about and is practically impossible to control. It may cause structural damage. Report as *Extreme Turbulence.** | |

* High level turbulence (normally above 15,000 feet ASL) not associated with cumuliform cloudiness, including thunderstorms, should be reported as CAT (clear air turbulence) preceded by the appropriate intensity, or light or moderate chop.

| INTENSITY | ICE ACCUMULATION |
|---|---|
| Trace | Ice becomes perceptible. Rate of accumulation slightly greater than rate of sublimation. It is not hazardous even though deicing/anti-icing equipment is not utilized, unless encountered for an extended period of time (over 1 hour). |
| Light | The rate of accumulation may create a problem if flight is prolonged in this environment (over 1 hour). Occasional use of deicing/anti-icing equipment removes/prevents accumulation. It does not present a problem if the deicing/anti-icing equipment is used. |
| Moderate | The rate of accumulation is such that even short encounters become potentially hazardous and use of deicing/anti-icing equipment or diversion is necessary. |
| Severe | The rate of accumulation is such that deicing/anti-icing equipment fails to reduce or control the hazard. Immediate diversion is necessary. |

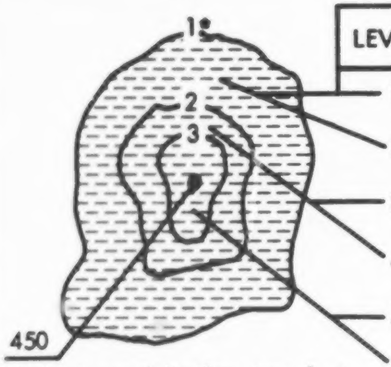
Pilot Report: Aircraft Identification, Location, Time (GMT), Intensity of Type,* Altitude/FL, Aircraft Type, IAS and OAT

## FORECAST WINDS AND TEMPERATURES ALOFT (FD)

| *Plotted* | *Interpretation* |
|---|---|
|  | 12° C, wind 060° at 5 knots |
|  | 3° C, wind 160° at 25 knots |
|  | −9° C, wind 260° at 50 knots |
|  | −47° C, wind 360° at 115 knots |
|  | −11° C, wind calm (light variable) |

LEGEND 38.—PIREP.

# KEY TO RADAR SUMMARY CHART



Highest precipitation tops in area in hundreds of feet.

| LEVEL | ECHO INTENSITY | PRECIPITATION INTENSITY | POSSIBLE TURBULENCE | WIND GUSTS | HAIL | LIGHTNING |
|---|---|---|---|---|---|---|
| 1 | WEAK | LIGHT | LGT/MDT | | | |
| 2 | MODERATE | MODERATE | LGT/MDT | | | |
| 3 | STRONG | HEAVY | SEVERE | | | |
| 4 | VERY STRONG | VERY HEAVY | SEVERE | POSSIBLE | POSSIBLE | YES |
| 5 | INTENSE | INTENSE | SEVERE | ORGANIZED | LIKELY | YES |
| 6 | EXTREME | EXTREME | SEVERE | EXTENSIVE | LARGE | YES |

* The numbers representing the intensity level do not appear on the chart. Beginning from the first contour line, bordering the area, the intensity level is 1-2; second contour is 3-4; and third contour is 5-6.

## SYMBOLS USED ON CHART

| SYMBOL | MEANING |
|---|---|
| R | RAIN |
| RW | RAIN SHOWERS |
| A | HAIL |
| S | SNOW |
| IP | ICE PELLETS |
| SW | SNOW SHOWERS |
| L | DRIZZLE |
| T | THUNDERSTORM |
| ZR, ZL | FREEZING PRECIPITATION |
| NE | NO ECHOES OBSERVED |
| NA | OBSERVATIONS UNAVAILABLE |
| OM | OUT FOR MAINTENANCE |
| STC | STC ON -- all precipitation may not be seen |

| SYMBOL | MEANING |
|---|---|
| + | INTENSITY INCREASING OR NEW ECHO |
| - | INTENSITY DECREASING |
| NO SYMBOL | NO CHANGE |
| ↗ 35 | CELL MOVEMENT TO NE AT 35 KNOTS |
| ⟶ | LINE OR AREA MOVEMENT TO EAST AT 20 KNOTS |
| MA | ECHOES MOSTLY ALOFT |
| PA | ECHOES PARTLY ALOFT |

| SYMBOL | MEANING |
|---|---|
| ▬ | LINE OF ECHOES |
| SLD | OVER 9/10 COVERAGE IN A LINE |
| WS999 | THUNDERSTORM WATCH |
| WT999 | TORNADO WATCH |
| LEWP | LINE ECHO WAVE PATTERN |

LEGEND 39.—Key to Radar Summary Chart.

# APPENDIX 3

Form Approved OMB No 2120-0026

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

## FLIGHT PLAN

(FAA USE ONLY) ☐ PILOT BRIEFING ☐ VNR ☐ STOPOVER

TIME STARTED

SPECIALIST INITIALS

1 TYPE: ☐ VFR ☒ IFR ☐ DVFR

2 AIRCRAFT IDENTIFICATION: N153

3 AIRCRAFT TYPE/SPECIAL EQUIPMENT: JET/R

4 TRUE AIRSPEED: KTS

5 DEPARTURE POINT: LAX

6 DEPARTURE TIME: PROPOSED (Z) ACTUAL (Z)

7 CRUISING ALTITUDE: FL270

8 ROUTE OF FLIGHT: LAX FLIPR2.TRM J169 SALOM INT SALOM.ARLIN5

9 DESTINATION (Name of airport and city): PHX PHOENIX

10 EST. TIME ENROUTE: HOURS MINUTES

11 REMARKS

12 FUEL ON BOARD: HOURS MINUTES

13 ALTERNATE AIRPORT(S): NA

14 PILOT'S NAME, ADDRESS & TELEPHONE NUMBER & AIRCRAFT HOME BASE

15 NUMBER ABOARD: 85

16 COLOR OF AIRCRAFT

17 DESTINATION CONTACT/TELEPHONE (OPTIONAL)

CIVIL AIRCRAFT PILOTS. FAR Part 91 requires you file an IFR flight plan to operate under instrument flight rules in controlled airspace. Failure to file could result in a civil penalty not to exceed $1,000 for each violation (Section 901 of the Federal Aviation Act of 1958, as amended). Filing of a VFR flight plan is recommended as a good operating practice. See also Part 99 for requirements concerning DVFR flight plans.

FAA Form 7233-1 (8-82) CLOSE VFR FLIGHT PLAN WITH ____________ FSS ON ARRIVAL

## FLIGHT LOG

| CHECK POINTS | | ROUTE | MACH | WIND | SPEED-KTS | | DIST | TIME | | FUEL | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM | TO | ALTITUDE | NO | TEMP | TAS | GS | NM | LEG | TOT | LEG | TOT |
| LAX | LEVEL OFF | FLIPR<br>CLIMB | | | | | | | :19 | | *4400 |
| LEVEL OFF | TRM | J169<br>FL 270 | | 330/45<br>ISA -2 | | | 21 | | | | |
| TRM | BLH | J169<br>FL270 | | 330/45<br>ISA -2 | | | | | | | |
| BLH | SALOM INT | J169<br>FL270 | | 340/42<br>ISA -2 | | | | | | | |
| SALOM INT | PHX | DESCENT AND APPROACH | | | | | | :10 | | 1250 | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

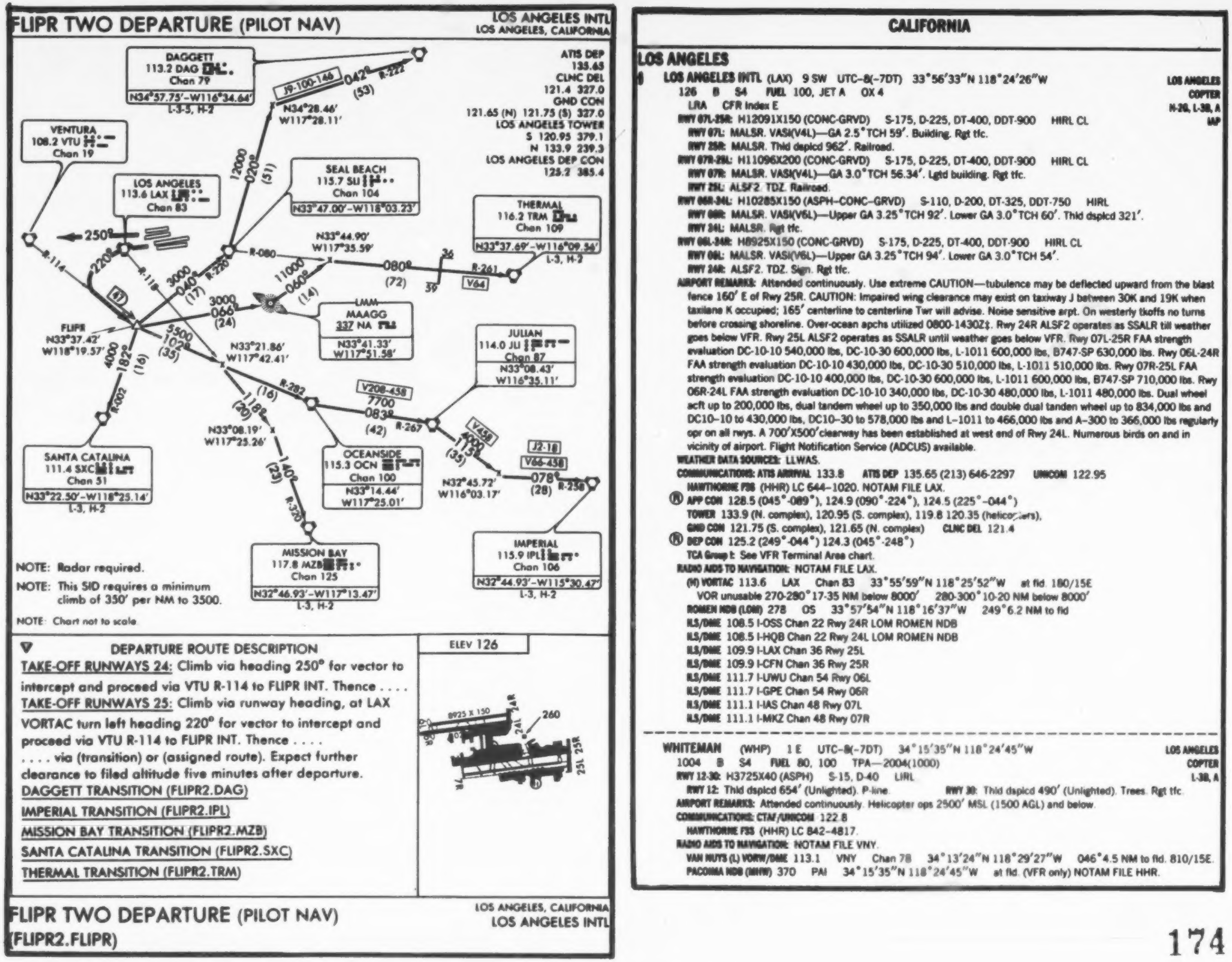
**OTHER DATA:** * Includes 1,000 lbs fuel for taxi.
NOTE: Use 10,500 PPH fuel from level off to SALOM INT.

Use 9,400 PPH fuel flow for reserve requirements.

**FLIGHT SUMMARY**

| TIME | FUEL | |
|---|---|---|
| | | EN ROUTE |
| | | RESERVE |
| -- | 1200 | MISSED APPR. |
| | | TOTAL |

FIGURE 1.—Flight Plan/Flight Log.


DAGGETT
113.2 DAG
Chan 79
N34°57.75′-W116°34.64′
L-3-5, H-2
J9-100-146
042°
R-222
(53)
N34°28.46′
W117°28.11′
VENTURA
108.2 VTU
Chan 19
12000
020°
(51)
LOS ANGELES
113.6 LAX
Chan 83
SEAL BEACH
115.7 SLI
Chan 104
N33°47.00′-W118°03.23′
250°
R-114
220°
R-118
R-220
R-080
N33°44.90′
W117°35.59′
080°
(72)
36
39
R-261
V64
THERMAL
116.2 TRM
Chan 109
N33°37.69′-W116°09.56′
L-3, H-2
(41)
3000
040°
(17)
11000
060°
(14)
3000
066°
(24)
LMM
MAAGG
337 NA
N33°41.33′
W117°51.58′
FLIPR
N33°37.42′
W118°19.57′
5500
102°
(35)
N33°21.86′
W117°42.41′
4000
182°
(16)
R-002
R-282
(16)
118°
(20)
N33°08.19′
W117°25.26′
V208-458
7700
083°
(42)
R-267
JULIAN
114.0 JU
Chan 87
N33°08.43′
W116°35.11′
V458
4000
115°
(35)
J2-18
V66-458
N32°45.72′
W116°03.17′
078°
(28)
R-258
SANTA CATALINA
111.4 SXC
Chan 51
N33°22.50′-W118°25.14′
L-3, H-2
OCEANSIDE
115.3 OCN
Chan 100
N33°14.44′
W117°25.01′
140°
(23)
R-320
MISSION BAY
117.8 MZB
Chan 125
N32°46.93′-W117°13.47′
L-3, H-2
IMPERIAL
115.9 IPL
Chan 106
N32°44.93′-W115°30.47′
L-3, H-2
ELEV 126
8925 X 150
24R
24L
260
25R
25L
6R
7L

## FLIPR TWO DEPARTURE (PILOT NAV)

LOS ANGELES INTL
LOS ANGELES, CALIFORNIA

ATIS DEP
135.65
CLNC DEL
121.4 327.0
GND CON
121.65 (N) 121.75 (S) 327.0
LOS ANGELES TOWER
S 120.95 379.1
N 133.9 239.3
LOS ANGELES DEP CON
125.2 385.4

NOTE: Radar required.

NOTE: This SID requires a minimum climb of 350′ per NM to 3500.

NOTE: Chart not to scale.

▽ DEPARTURE ROUTE DESCRIPTION

TAKE-OFF RUNWAYS 24: Climb via heading 250° for vector to intercept and proceed via VTU R-114 to FLIPR INT. Thence . . . .

TAKE-OFF RUNWAYS 25: Climb via runway heading, at LAX VORTAC turn left heading 220° for vector to intercept and proceed via VTU R-114 to FLIPR INT. Thence . . . .

. . . . via (transition) or (assigned route). Expect further clearance to filed altitude five minutes after departure.

DAGGETT TRANSITION (FLIPR2.DAG)

IMPERIAL TRANSITION (FLIPR2.IPL)

MISSION BAY TRANSITION (FLIPR2.MZB)

SANTA CATALINA TRANSITION (FLIPR2.SXC)

THERMAL TRANSITION (FLIPR2.TRM)

FLIPR TWO DEPARTURE (PILOT NAV)
(FLIPR2.FLIPR)

LOS ANGELES, CALIFORNIA
LOS ANGELES INTL

173

## CALIFORNIA

### LOS ANGELES

**LOS ANGELES INTL** (LAX) 9 SW UTC–8(–7DT) 33°56′33″N 118°24′26″W
126 B S4 **FUEL** 100, JET A OX 4
LRA CFR Index E

**LOS ANGELES**
**COPTER**
**H-2B, L-3B, A**
**IAP**

**RWY 07L-25R:** H12091X150 (CONC-GRVD) S-175, D-225, DT-400, DDT-900 HIRL CL
**RWY 07L:** MALSR. VASI(V4L)—GA 2.5°TCH 59′. Building. Rgt tfc.
**RWY 25R:** MALSR. Thld dsplcd 962′. Railroad.
**RWY 07R-25L:** H11096X200 (CONC-GRVD) S-175, D-225, DT-400, DDT-900 HIRL CL
**RWY 07R:** MALSR. VASI(V4L)—GA 3.0°TCH 56.34′. Lgtd building. Rgt tfc.
**RWY 25L:** ALSF2. TDZ. Railroad.
**RWY 06R-24L:** H10285X150 (ASPH–CONC–GRVD) S-110, D-200, DT-325, DDT-750 HIRL
**RWY 06R:** MALSR. VASI(V6L)—Upper GA 3.25°TCH 92′. Lower GA 3.0°TCH 60′. Thld dsplcd 321′.
**RWY 24L:** MALSR. Rgt tfc.
**RWY 06L-24R:** H8925X150 (CONC-GRVD) S-175, D-225, DT-400, DDT-900 HIRL CL
**RWY 06L:** MALSR. VASI(V6L)—Upper GA 3.25°TCH 94′. Lower GA 3.0°TCH 54′.
**RWY 24R:** ALSF2. TDZ. Sign. Rgt tfc.

**AIRPORT REMARKS:** Attended continuously. Use extreme CAUTION—tubulence may be deflected upward from the blast fence 160′ E of Rwy 25R. CAUTION: Impaired wing clearance may exist on taxiway J between 30K and 19K when taxilane K occupied; 165′ centerline to centerline Twr will advise. Noise sensitive arpt. On westerly tkoffs no turns before crossing shoreline. Over-ocean apchs utilized 0800-1430Z‡. Rwy 24R ALSF2 operates as SSALR till weather goes below VFR. Rwy 25L ALSF2 operates as SSALR until weather goes below VFR. Rwy 07L-25R FAA strength evaluation DC-10-10 540,000 lbs, DC-10-30 600,000 lbs, L-1011 600,000 lbs, B747-SP 630,000 lbs. Rwy 06L-24R FAA strength evaluation DC-10-10 430,000 lbs, DC-10-30 510,000 lbs, L-1011 510,000 lbs. Rwy 07R-25L FAA strength evaluation DC-10-10 400,000 lbs, DC-10-30 600,000 lbs, L-1011 600,000 lbs, B747-SP 710,000 lbs. Rwy 06R-24L FAA strength evaluation DC-10-10 340,000 lbs, DC-10-30 480,000 lbs, L-1011 480,000 lbs. Dual wheel acft up to 200,000 lbs, dual tandem wheel up to 350,000 lbs and double dual tanden wheel up to 834,000 lbs and DC10–10 to 430,000 lbs, DC10–30 to 578,000 lbs and L–1011 to 466,000 lbs and A–300 to 366,000 lbs regularly opr on all rwys. A 700′X500′clearway has been established at west end of Rwy 24L. Numerous birds on and in vicinity of airport. Flight Notification Service (ADCUS) available.

**WEATHER DATA SOURCES:** LLWAS.

**COMMUNICATIONS: ATIS ARRIVAL** 133.8 **ATIS DEP** 135.65 (213) 646-2297 **UNICOM** 122.95
**HAWTHORNE FSS** (HHR) LC 644–1020. NOTAM FILE LAX.
Ⓡ **APP CON** 128.5 (045°-089°), 124.9 (090°-224°), 124.5 (225°–044°)
**TOWER** 133.9 (N. complex), 120.95 (S. complex), 119.8 120.35 (helicopters),
**GND CON** 121.75 (S. complex), 121.65 (N. complex) **CLNC DEL** 121.4
Ⓡ **DEP CON** 125.2 (249°-044°) 124.3 (045°-248°)
**TCA Group I:** See VFR Terminal Area chart.

**RADIO AIDS TO NAVIGATION:** NOTAM FILE LAX.
**(H) VORTAC** 113.6 LAX Chan 83 33°55′59″N 118°25′52″W at fld. 180/15E
VOR unusable 270-280° 17-35 NM below 8000′ 280-300° 10-20 NM below 8000′
**ROMEN NDB (LOM)** 278 OS 33°57′54″N 118°16′37″W 249° 6.2 NM to fld
**ILS/DME** 108.5 I-OSS Chan 22 Rwy 24R LOM ROMEN NDB
**ILS/DME** 108.5 I-HQB Chan 22 Rwy 24L LOM ROMEN NDB
**ILS/DME** 109.9 I-LAX Chan 36 Rwy 25L
**ILS/DME** 109.9 I-CFN Chan 36 Rwy 25R
**ILS/DME** 111.7 I-UWU Chan 54 Rwy 06L
**ILS/DME** 111.7 I-GPE Chan 54 Rwy 06R
**ILS/DME** 111.1 I-IAS Chan 48 Rwy 07L
**ILS/DME** 111.1 I-MKZ Chan 48 Rwy 07R

- - - - - - - - - - - - - - - - - - - - - - - - - -

**WHITEMAN** (WHP) 1 E UTC–8(–7DT) 34°15′35″N 118°24′45″W
1004 B S4 **FUEL** 80, 100 TPA—2004(1000)

**LOS ANGELES**
**COPTER**
**L-3B, A**

**RWY 12-30:** H3725X40 (ASPH) S-15, D-40 LIRL
**RWY 12:** Thld dsplcd 654′ (Unlighted). P-line. **RWY 30:** Thld dsplcd 490′ (Unlighted). Trees. Rgt tfc.
**AIRPORT REMARKS:** Attended continuously. Helicopter ops 2500′ MSL (1500 AGL) and below.
**COMMUNICATIONS: CTAF/UNICOM** 122.8
**HAWTHORNE FSS** (HHR) LC 842–4817.
**RADIO AIDS TO NAVIGATION:** NOTAM FILE VNY.
**VAN NUYS (L) VORW/DME** 113.1 VNY Chan 78 34°13′24″N 118°29′27″W 046° 4.5 NM to fld. 810/15E.
**PACOIMA NDB (MHW)** 370 PAI 34°15′35″N 118°24′45″W at fld. (VFR only) NOTAM FILE HHR.

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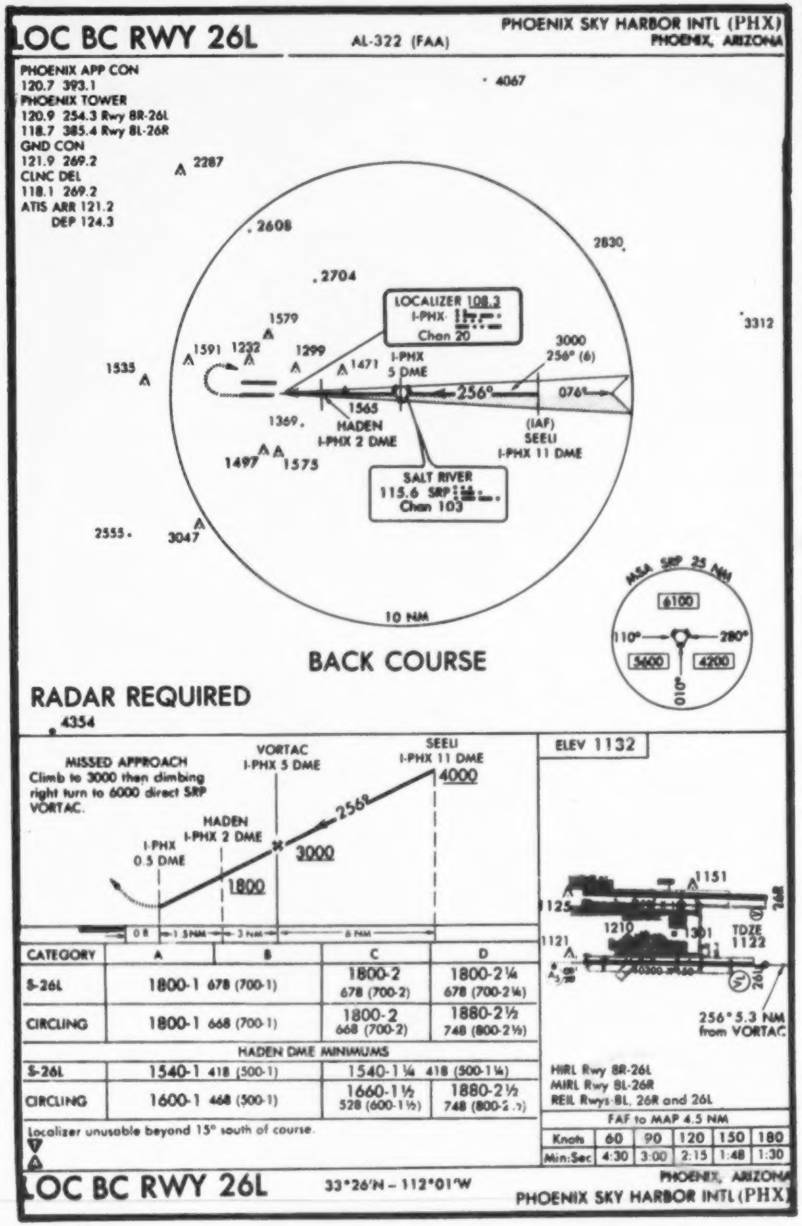
FIGURE 2.—FLIPR Two Departure (Pilot Nav).

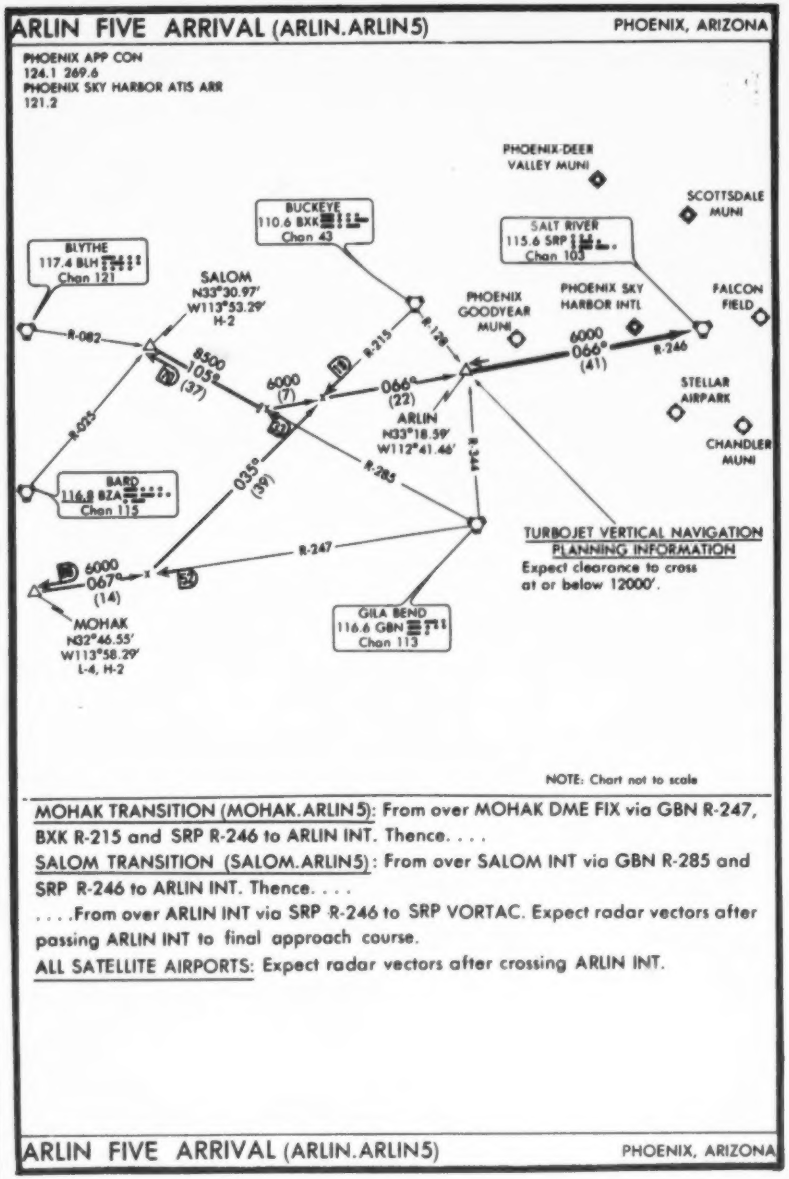

LOC BC RWY 26L
AL-322 (FAA)
PHOENIX SKY HARBOR INTL (PHX)
PHOENIX, ARIZONA
PHOENIX APP CON
120.7 393.1
PHOENIX TOWER
120.9 254.3 Rwy 8R-26L
118.7 385.4 Rwy 8L-26R
GND CON
121.9 269.2
CLNC DEL
118.1 269.2
ATIS ARR 121.2
DEP 124.3
LOCALIZER 108.3
I-PHX
Chan 20
I-PHX 5 DME
3000
256° (6)
076°
256°
HADEN
I-PHX 2 DME
(IAF)
SEELI
I-PHX 11 DME
SALT RIVER
115.6 SRP
Chan 103
10 NM
BACK COURSE
RADAR REQUIRED
MSA SRP 25 NM
6100
5600
4200
110°
280°
010°
MISSED APPROACH
Climb to 3000 then climbing right turn to 6000 direct SRP VORTAC.
VORTAC
I-PHX 5 DME
SEELI
I-PHX 11 DME
4000
HADEN
I-PHX 2 DME
3000
I-PHX
0.5 DME
1800
0.8
1.5 NM
3 NM
6 NM
ELEV 1132
TDZE 1122
256° 5.3 NM from VORTAC
HIRL Rwy 8R-26L
MIRL Rwy 8L-26R
REIL Rwys 8L, 26R and 26L

| CATEGORY | A | B | C | D |
|---|---|---|---|---|
| S-26L | 1800-1 678 (700-1) | | 1800-2<br>678 (700-2) | 1800-2¼<br>678 (700-2¼) |
| CIRCLING | 1800-1 668 (700-1) | | 1800-2<br>668 (700-2) | 1880-2½<br>748 (800-2½) |
| HADEN DME MINIMUMS | | | | |
| S-26L | 1540-1 418 (500-1) | | 1540-1¼ 418 (500-1¼) | |
| CIRCLING | 1600-1 468 (500-1) | | 1660-1½<br>528 (600-1½) | 1880-2½<br>748 (800-2½) |

Localizer unusable beyond 15° south of course.

| FAF to MAP 4.5 NM | | | | | |
|---|---|---|---|---|---|
| Knots | 60 | 90 | 120 | 150 | 180 |
| Min:Sec | 4:30 | 3:00 | 2:15 | 1:48 | 1:30 |

LOC BC RWY 26L 33°26'N – 112°01'W PHOENIX, ARIZONA PHOENIX SKY HARBOR INTL (PHX)


ARLIN FIVE ARRIVAL (ARLIN.ARLIN5)
PHOENIX, ARIZONA
PHOENIX APP CON
124.1 269.6
PHOENIX SKY HARBOR ATIS ARR
121.2
BLYTHE
117.4 BLH
Chan 121
BUCKEYE
110.6 BXK
Chan 43
SALT RIVER
115.6 SRP
Chan 103
BARD
116.8 BZA
Chan 115
GILA BEND
116.6 GBN
Chan 113
SALOM
N33°30.97'
W113°53.29'
H-2
ARLIN
N33°18.59'
W112°41.46'
MOHAK
N32°46.55'
W113°58.29'
L-4, H-2
PHOENIX-DEER VALLEY MUNI
SCOTTSDALE MUNI
PHOENIX GOODYEAR MUNI
PHOENIX SKY HARBOR INTL
FALCON FIELD
STELLAR AIRPARK
CHANDLER MUNI
R-082
R-025
R-215
R-128
R-246
R-285
R-344
R-247
8500
105°
(37)
6000
(7)
066°
(22)
6000
066°
(41)
035°
(39)
6000
067°
(14)
TURBOJET VERTICAL NAVIGATION PLANNING INFORMATION
Expect clearance to cross at or below 12000'.
NOTE: Chart not to scale

**MOHAK TRANSITION (MOHAK.ARLIN5):** From over MOHAK DME FIX via GBN R-247, BXK R-215 and SRP R-246 to ARLIN INT. Thence. . . .

**SALOM TRANSITION (SALOM.ARLIN5):** From over SALOM INT via GBN R-285 and SRP R-246 to ARLIN INT. Thence. . . .

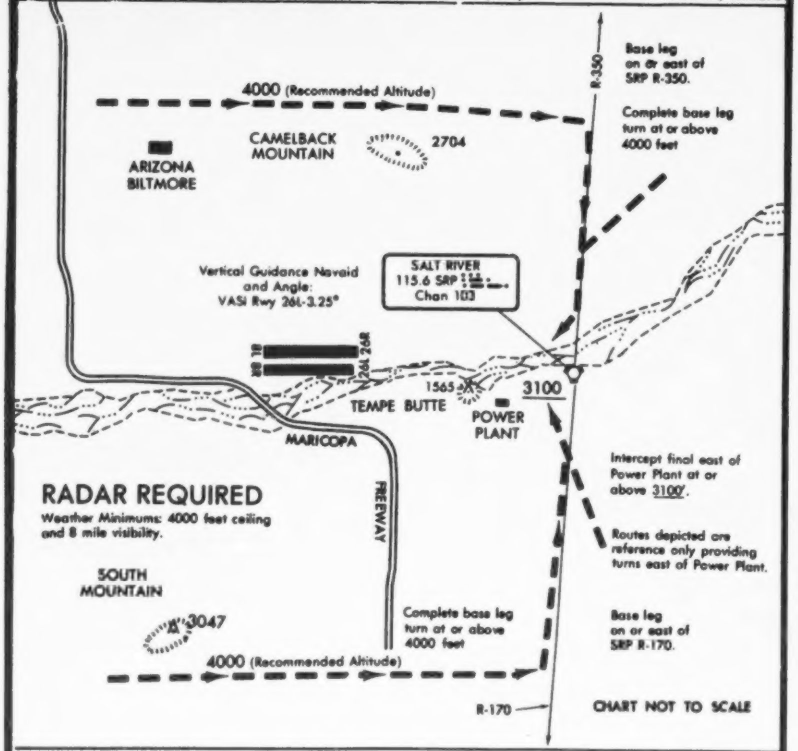
. . . .From over ARLIN INT via SRP R-246 to SRP VORTAC. Expect radar vectors after passing ARLIN INT to final approach course.

**ALL SATELLITE AIRPORTS:** Expect radar vectors after crossing ARLIN INT.

ARLIN FIVE ARRIVAL (ARLIN.ARLIN5) PHOENIX, ARIZONA

FIGURE 3.—Arlin Five Arrival/LOC BC RWY 26L.

**POWER PLANT VISUAL RWY 26L** AL-322 (FAA) PHOENIX, ARIZONA


R-350
Base leg
on or east of
SRP R-350.
4000 (Recommended Altitude)
Complete base leg
turn at or above
4000 feet
CAMELBACK
MOUNTAIN
2704
ARIZONA
BILTMORE
Vertical Guidance Navaid
and Angle:
VASI Rwy 26L-3.25°
SALT RIVER
115.6 SRP
Chan 103
08L
26R
08R
26L
1565
TEMPE BUTTE
3100
POWER
PLANT
MARICOPA
FREEWAY
RADAR REQUIRED
Weather Minimums: 4000 feet ceiling
and 8 mile visibility.
Intercept final east of
Power Plant at or
above 3100′.
Routes depicted are
reference only providing
turns east of Power Plant.
SOUTH
MOUNTAIN
3047
Complete base leg
turn at or above
4000 feet
Base leg
on or east of
SRP R-170.
4000 (Recommended Altitude)
R-170
CHART NOT TO SCALE

POWER PLANT VISUAL RWY 26L

When visual approaches to Runway 26L are in progress, clearances will be given utilizing in part the following phraseology:

"(IDENT) CLEARED FOR A POWER PLANT VISUAL RUNWAY 26L APPROACH."

**POWER PLANT VISUAL RWY 26L** 33°26′N - 112°01′W PHOENIX, ARIZONA
PHOENIX SKY HARBOR INTL (PHX)

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**ARIZONA**

§ **PHOENIX SKY HARBOR INTL** (PHX) 3 E UTC–7 33°26′10″N 112°00′32″W — PHOENIX H-2H, L-4E IAP

1132 B S4 **FUEL** 80, 100, 100LL, JET A OX 1, 2, 3, 4 TPA—See Remarks
LRA CFR Index E

**RWY 08L-26R:** H11001X150 (ASPH-GRVD) S-30, D-170, DT-280, DDT-620 MIRL
**RWY 08L:** REIL. VASI(V4L)—GA 3.0°TCH 55′. Building.
**RWY 26R:** REIL. VASI(V4L)—GA 3.0°TCH 60′. Pole. Rgt tfc.

**RWY 08R-26L:** H10300X150 (ASPH-GRVD) S-30, D-200, DT-400, DDT-620 HIRL
**RWY 08R:** MALSR. Rgt tfc.
**RWY 26L:** REIL. VASI(V6L)—Upper GA 3.25°TCH 90′. Lower GA 3.0°TCH 53′. Antenna.

**AIRPORT REMARKS:** Attended continuously. Training by civil turbojet acft prohibited except PPR. TPA—2132(1000) lgt acft and non-turbo jets; 2632(1500) heavy acft and turbojets. Unless advised by ATC all turbine acft and acft 12,500 lbs and over remain at or above 3000′ MSL until established on final. Fly base leg at least 5 mi from arpt. Overnight parking fee. Fee for all charters; travel clubs and certain revenue producing aircraft. Taxiway A–6, B–4, B–8 limited to 68,000 GWT. Rwy 08L-26R gross weight limit DC-10-10 430,000 pounds, DC-10-30/40 540,000 pounds, L-1011-1 430,000 pounds, aircraft up to DDTW 620,000 pounds, DC-10-10 430,000 pounds, DC-10-30/40 540,000 pounds, L-1011-1 430,000 pounds regularly operate on rwy. Rwy 08R-26L gross weight limit DC-10-10 430,000 pounds, DC-10-30/40 540,000 pounds, L-1011-1 430,000 pounds. Flight Notification Service (ADCUS) available.

**WEATHER DATA SOURCES:** LLWAS.

**COMMUNICATIONS: ATIS ARRIVAL** 121.2 (602) 244-0963 **ATIS DEP** 124.3 **UNICOM** 122.95
**PRESCOTT FSS** (PRC) LC 257–9792 NOTAM FILE PHX.
**RCO** 122.6 122.2 (PRESCOTT FSS)
Ⓡ **APP/DEP CON** 126.8 (259°–309°) 124.9 (053°–146°) 124.1 (147°–258° above 5500′) 123.7 (147°–258° 5500′ and below) 120.7 (310°–052° 5500′ and below) 119.2 (310°–052° above 5500′)
**TOWER** 118.7 (Rwy 08L-26R), 120.9 (Rwy 08R-26L) **GND CON** 121.9, 121.85 **CLNC DEL** 118.1
**ARSA** ctc **APP CON**

**RADIO AIDS TO NAVIGATION:** NOTAM FILE PHX.
**SALT RIVER (H) VORTAC** 115.6 SRP Chan 103 33°25′53″N 111°53′17″W 256°5.3 NM to fld. 1185/14E.
**ILS/DME** 108.3 I-PHX Chan 20 Rwy 08R. GS unusable below 1280′. LOC back course unusable beyond 20° south of course.

**PIMA**

**FLYING J RANCH** (E37) 4 SW UTC–7 32°50′52″N 109°52′52″W — PHOENIX
3100
**RWY 01-19:** 2980X80 (TURF)
**RWY 01:** Brush. **RWY 19:** Thld dsplcd 250′. Brush.
**AIRPORT REMARKS:** Attended continuously. Rwy 01-19 surface in rough condition with water erosion on first 1000′NE end.
**COMMUNICATIONS: CTAF** 122.9
**PRESCOTT FSS** (PRC) Toll free call, dial 602–778–0314.

**PINAL AIRPARK** (See MARANA)

**PRESCOTT** — PHOENIX L-4E
**FSS** (PRC) on Earnest A Love Fld. 122.4 122.2. 602-778-0314

FIGURE 4.—Power Plant Visual RWY 26L.

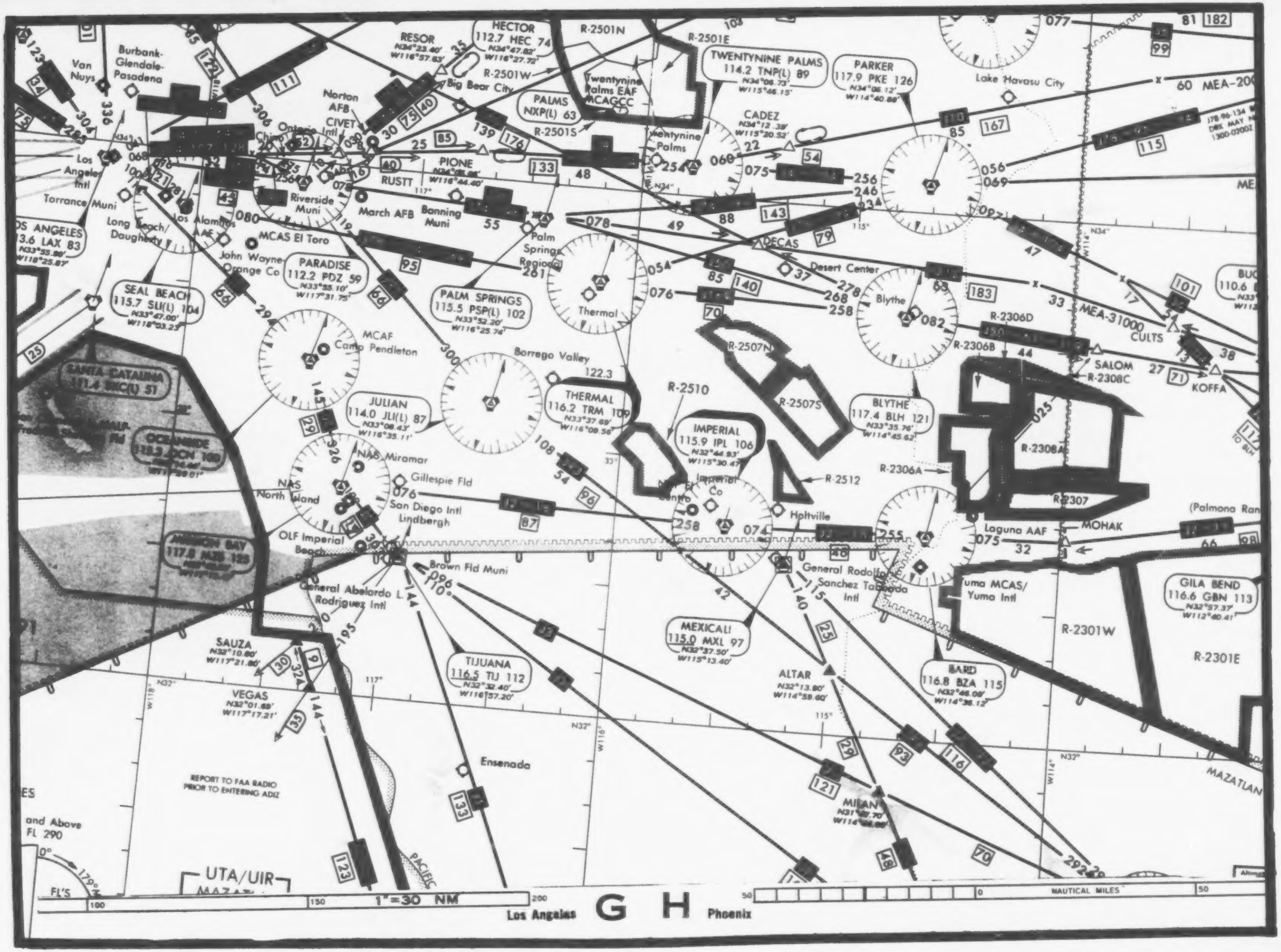

HECTOR 112.7 HEC 74
RESOR
R-2501N
R-2501E
TWENTYNINE PALMS 114.2 TNP(L) 89
PARKER 117.9 PKE 126
Lake Havasu City
Burbank-Glendale-Pasadena
Van Nuys
Norton AFB
Big Bear City
R-2501W
PALMS NXP(L) 63
Twentynine Palms EAF MCAGCC
R-2501S
CADEZ
Ontario Intl
CIVET
Chino
Los Angeles Intl
Torrance Muni
PIONE
RUSTT
Riverside Muni
March AFB
Banning Muni
Twentynine Palms
Long Beach/Daugherty
Los Alamitos AAF
MCAS El Toro
John Wayne-Orange Co
LOS ANGELES 113.6 LAX 83
PARADISE 112.2 PDZ 59
Palm Springs Regional
DECAS
Desert Center
Blythe
SEAL BEACH 115.7 SLI(L) 104
PALM SPRINGS 115.5 PSP(L) 102
Thermal
R-2306D
R-2306B
CULTS
SALOM
R-2308C
KOFFA
MEA-31000
60 MEA-20
MCAF Camp Pendleton
Borrego Valley
R-2507N
SANTA CATALINA 111.4 SXC(L) 51
THERMAL 116.2 TRM 109
R-2510
R-2507S
BLYTHE 117.4 BLH 121
JULIAN 114.0 JLI(L) 87
IMPERIAL 115.9 IPL 106
R-2308A
OCEANSIDE 113.3 OCN 100
NAS Miramar
Gillespie Fld
Imperial Co
R-2512
R-2306A
R-2307
NAS North Island
San Diego Intl Lindbergh
El Centro
Holtville
Laguna AAF
MOHAK
(Palmona Ran
OLF Imperial Beach
MISSION BAY 117.8 MZB 125
Brown Fld Muni
General Rodolfo Sanchez Taboada Intl
Yuma MCAS/Yuma Intl
General Abelardo L. Rodriguez Intl
GILA BEND 116.6 GBN 113
MEXICALI 115.0 MXL 97
R-2301W
R-2301E
SAUZA
TIJUANA 116.5 TIJ 112
ALTAR
BARD 116.8 BZA 115
VEGAS
Ensenada
MAZATLAN
REPORT TO FAA RADIO PRIOR TO ENTERING ADIZ
MILAN
and Above FL 290
UTA/UIR
FL'S
1" = 30 NM
NAUTICAL MILES
Los Angeles
G
H
Phoenix

FIGURE 5.—IFR En Route High Altitude Chart Segment.

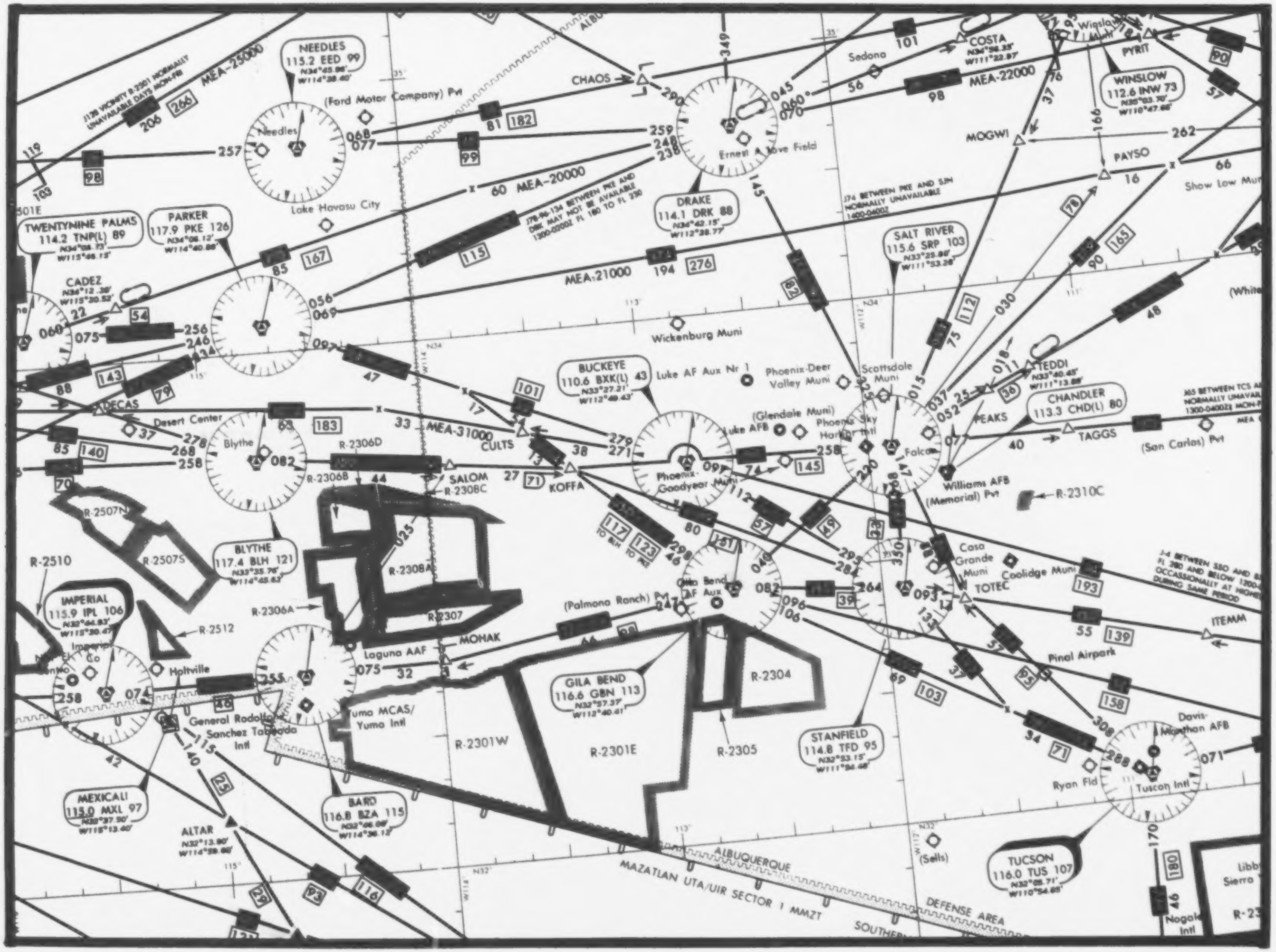

NEEDLES
115.2 EED 99
N34°45.96'
W114°28.40'
Needles
(Ford Motor Company) Pvt
Lake Havasu City
MEA-25000
MEA-20000
MEA-22000
MEA:21000
MEA-31000
CHAOS
COSTA
Sedona
Winslow
PYRIT
WINSLOW
112.6 INW 73
MOGWI
PAYSO
Show Low Muni
Ernest A. Love Field
DRAKE
114.1 DRK 88
N34°42.15'
W112°28.77'
TWENTYNINE PALMS
114.2 TNP(L) 89
PARKER
117.9 PKE 126
N34°06.12'
W114°40.88'
CADEZ
SALT RIVER
115.6 SRP 103
N33°25.86'
W111°53.28'
Wickenburg Muni
BUCKEYE
110.6 BXK(L) 43
N33°27.21'
W112°49.43'
Luke AF Aux Nr 1
Phoenix-Deer Valley Muni
Scottsdale Muni
TEDDI
CHANDLER
113.3 CHD(L) 80
TAGGS
(San Carlos) Pvt
PEAKS
Falcon
DECAS
Desert Center
Blythe
CULTS
SALOM
KOFFA
R-2306D
R-2306B
R-2308C
R-2308A
R-2306A
R-2307
R-2310C
Phoenix-Goodyear Muni
(Glendale Muni)
Luke AFB
Phoenix Sky Harbor Intl
Williams AFB (Memorial) Pvt
R-2507N
R-2507S
R-2510
R-2512
BLYTHE
117.4 BLH 121
N33°35.76'
W114°45.63'
IMPERIAL
115.9 IPL 106
N32°44.83'
W115°30.47'
Imperial Co
Holtville
El Centro
General Rodolfo Sanchez Taboada Intl
MEXICALI
115.0 MXL 97
N32°37.50'
W115°13.40'
ALTAR
N32°13.90'
W114°59.66'
BARD
116.8 BZA 115
N32°46.08'
W114°36.12'
Yuma MCAS/Yuma Intl
Laguna AAF
MOHAK
(Palmona Ranch) Pvt
Gila Bend AF Aux
GILA BEND
116.6 GBN 113
N32°57.37'
W112°40.41'
R-2301W
R-2301E
R-2304
R-2305
Casa Grande Muni
Coolidge Muni
TOTEC
ITEMM
Pinal Airpark
STANFIELD
114.8 TFD 95
N32°53.15'
W111°54.46'
Davis-Monthan AFB
Ryan Fld
Tucson Intl
TUCSON
116.0 TUS 107
N32°05.71'
W110°54.85'
(Sells)
Nogales Intl
ALBUQUERQUE
MAZATLAN UTA/UIR SECTOR 1 MMZT
DEFENSE AREA
SOUTHERN
(White
Libby
Sierra
1125 VICINITY R-2301 NORMALLY UNAVAILABLE DAYS MON-FRI
J78-96-134 BETWEEN PKE AND DRK MAY NOT BE AVAILABLE 1300-0200Z FL 180 TO FL 230
J74 BETWEEN PKE AND SJN NORMALLY UNAVAILABLE 1400-0400Z
J65 BETWEEN TCS AND ... NORMALLY UNAVAILABLE 1300-0400Z MON-FRI
J-4 BETWEEN SSO AND ... FL 280 AND BELOW 1200... OCCASSIONALLY AT HIGHER ... DURING SAME PERIOD
TO BLH
TO PKE

**Figure 5A.**—IFR En Route High Altitude Chart Segment.

Form Approved OMB No 2120-0026

| | | | |
|---|---|---|---|
| U.S. DEPARTMENT OF TRANSPORTATION<br>FEDERAL AVIATION ADMINISTRATION<br>**FLIGHT PLAN** | (FAA USE ONLY) ☐ PILOT BRIEFING ☐ VNR<br>☐ STOPOVER | TIME STARTED | SPECIALIST INITIALS |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 TYPE<br>☐ VFR<br>☑ IFR<br>☐ DVFR | 2 AIRCRAFT IDENTIFICATION<br>N853PC | 3 AIRCRAFT TYPE/ SPECIAL EQUIPMENT<br>BE1900/A | 4 TRUE AIRSPEED<br>233 KTS | 5 DEPARTURE POINT<br>TUC INTL | 6 DEPARTURE TIME<br>PROPOSED (Z)<br>ACTUAL (Z) | 7 CRUISING ALTITUDE<br>FL 220 |

8 ROUTE OF FLIGHT

TUC-TUC2.GBN VIA J104 TPN VIA TPN.DOWNE2 - LAX

| | | |
|---|---|---|
| 9 DESTINATION (Name of airport and city) LAX INTL<br>LOS ANGELES | 10 EST. TIME ENROUTE<br>HOURS<br>MINUTES | 11 REMARKS |

| | | | |
|---|---|---|---|
| 12 FUEL ON BOARD<br>HOURS<br>MINUTES | 13 ALTERNATE AIRPORT(S)<br>NA | 14 PILOT'S NAME, ADDRESS & TELEPHONE NUMBER & AIRCRAFT HOME BASE<br>17 DESTINATION CONTACT/TELEPHONE (OPTIONAL) | 15 NUMBER ABOARD<br>18 |

16 COLOR OF AIRCRAFT

CIVIL AIRCRAFT PILOTS. FAR Part 91 requires you file an IFR flight plan to operate under instrument flight rules in controlled airspace. Failure to file could result in a civil penalty not to exceed $1,000 for each violation (Section 901 of the Federal Aviation Act of 1958, as amended). Filing of a VFR flight plan is recommended as a good operating practice. See also Part 99 for requirements concerning DVFR flight plans.

FAA Form 7233-1 (8-82) CLOSE VFR FLIGHT PLAN WITH__________ FSS ON ARRIVAL

## FLIGHT LOG

| CHECK POINTS | | ROUTE | MACH | WIND | SPEED-KTS | | DIST | TIME | | FUEL | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM | TO | ALTITUDE | NO | TEMP | TAS | GS | NM | LEG | TOT | LEG | TOT |
| TUS | LEVEL OFF | TUS2.GBN<br>CLIMB | | | | | 73 | | :25 | | *350 |
| LEVEL OFF | GBN | TUS2.GBN<br>FL220 | | 280/46<br>ISA -3 | | | | | | | |
| GBN | INT J104 | J104<br>FL220 | | 280/46<br>ISA -3 | | | | | | | |
| INT J104 | PKE | J104<br>FL220 | | 280/46<br>ISA -3 | | | | | | | |
| PKE | TNP | J104<br>FL220 | | 280/46<br>ISA -3 | | | | | | | |
| TNP | START DESCENT | J104<br>FL220 | | 280/46<br>ISA -3 | | | | | | | |
| START DESCENT | DOWNE2 LAX | (DESCENT AND APPROACH | | | | | 52 | :18 | | 170 | |

**OTHER DATA:** * Includes fuel for taxi.

NOTE: Use 676 PPH total fuel flow from level off to start descent.
Use 726 PPH fuel flow for reserve requirements.

**FLIGHT SUMMARY**

| TIME | FUEL | |
|---|---|---|
| | | EN ROUTE |
| | | RESERVE |
| -- | 120 | MISSED APPR. |
| | | TOTAL |

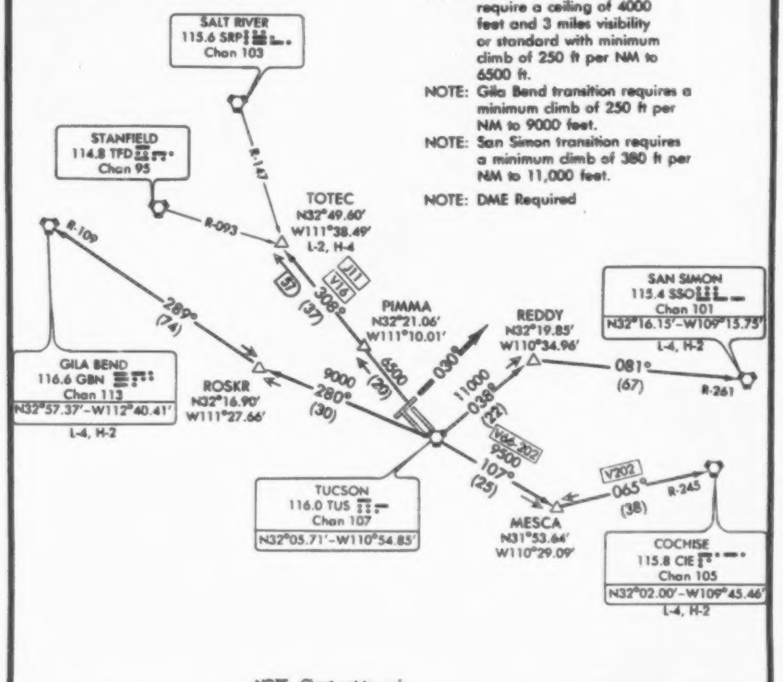
FIGURE 6.—Flight Plan/Flight Log.

(TUS2.TUS) 87323

## TUCSON TWO DEPARTURE (PILOT NAV)

TUCSON INTL
TUCSON, ARIZONA

CLNC DEL
126.65 326.2
ATIS 123.8 320.1


SALT RIVER
115.6 SRP
Chan 103
STANFIELD
114.8 TFD
Chan 95
R-147
R-093
R-109
TOTEC
N32°49.60'
W111°38.49'
L-2, H-4
(57)
V16
J11
308°
(37)
PIMMA
N32°21.06'
W111°10.01'
6500
(29)
030°
REDDY
N32°19.85'
W110°34.96'
081°
(67)
SAN SIMON
115.4 SSO
Chan 101
N32°16.15'-W109°15.75'
L-4, H-2
R-261
GILA BEND
116.6 GBN
Chan 113
N32°57.37'-W112°40.41'
L-4, H-2
289°
(74)
ROSKR
N32°16.90'
W111°27.66'
9000
280°
(30)
11000
038°
(22)
V66-202
9500
107°
(25)
TUCSON
116.0 TUS
Chan 107
N32°05.71'-W110°54.85'
MESCA
N31°53.64'
W110°29.09'
V202
065°
(38)
R-245
COCHISE
115.8 CIE
Chan 105
N32°02.00'-W109°45.46'
L-4, H-2

NOTE: Rwys 3, 11L/R, 21, 29L/R require a ceiling of 4000 feet and 3 miles visibility or standard with minimum climb of 250 ft per NM to 6500 ft.

NOTE: Gila Bend transition requires a minimum climb of 250 ft per NM to 9000 feet.

NOTE: San Simon transition requires a minimum climb of 380 ft per NM to 11,000 feet.

NOTE: DME Required

NOTE: Chart not to scale.

▼

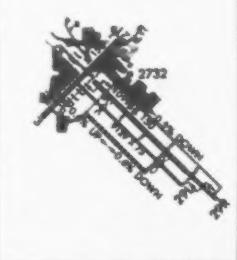
### DEPARTURE ROUTE DESCRIPTION

TAKE-OFF RUNWAYS 11L/R, 21, 29L/R: Fly assigned heading to intercept appropriate transition. Maintain 17,000 feet, or assigned lower altitude. Expect clearance to filed flight level 10 minutes after departure.

TAKE-OFF RUNWAY 3: Fly heading 030° for vector to appropriate transition. Maintain 17,000 feet or assigned lower altitude. Expect clearance to filed flight level 10 minutes after departure.

(Continued on next page)

ELEV 2641



TUCSON TWO DEPARTURE (PILOT NAV)
(TUS2.TUS)

TUCSON, ARIZONA
TUCSON INTL

(TUS 2. TUS)

## TUCSON TWO DEPARTURE (PILOT NAV)

TUCSON INTL
TUCSON, ARIZONA

### DEPARTURE ROUTE DESCRIPTION
(Continued)

SAN SIMON TRANSITION (TUS2.SSO): Via TUS R-038 and SSO R-261 to SSO VORTAC.

COCHISE TRANSITION (TUS2.CIE): Via TUS R-107 and CIE R-245 to CIE VORTAC.

TOTEC TRANSITION (TUS2.TOTEC): Via TUS R-308 to TOTEC INT.

GILA BEND TRANSITION (TUS2.GBN): Via TUS R-280 and GBN R-109 to GBN VORTAC.

### ARIZONA

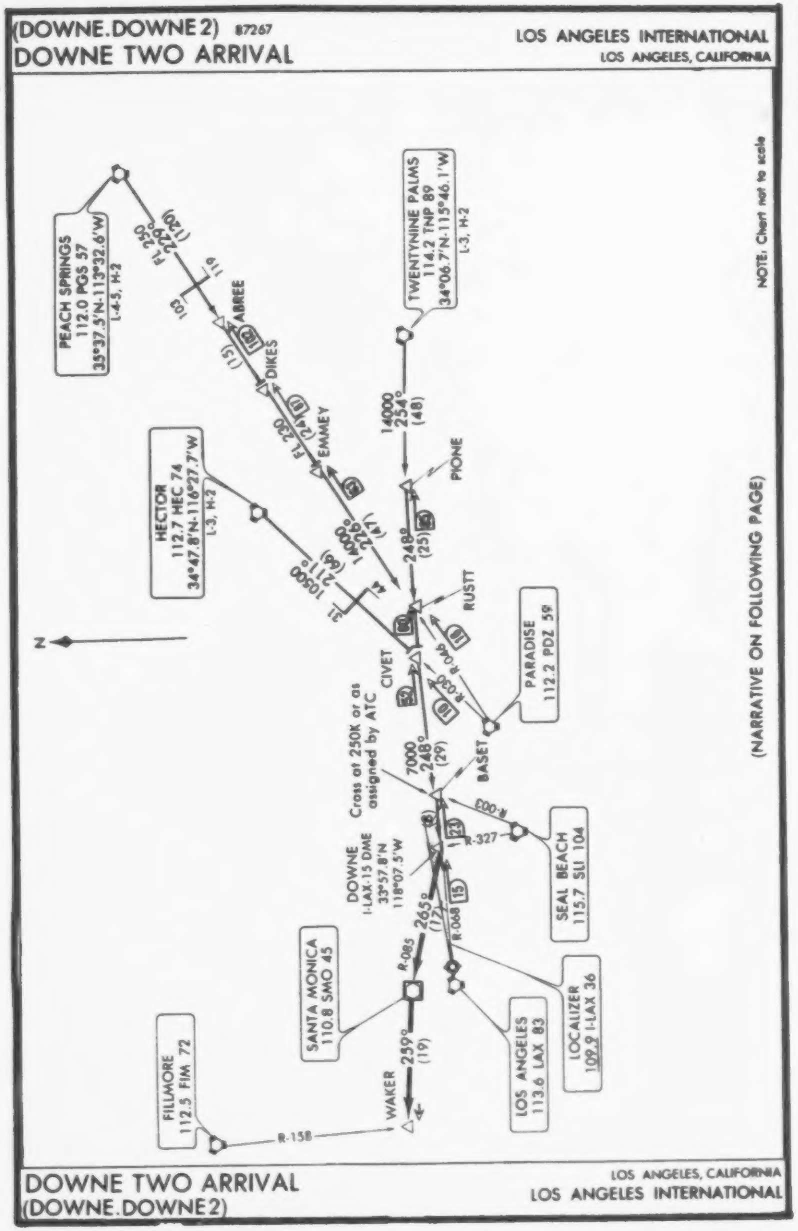
§ **TUCSON INTL** (TUS) 6 S UTC–7 32°06'58"N 110°56'26"W **PHOENIX**
2641 B S4 **FUEL** 100, 100LL, JET A OX 1, 2, 3, 4 AOE CFR Index D **H-2H, L-4F**
**RWY 11L-29R:** H10994X150 (ASPH-PFC) S-160, D-200, DT-350, DDT-585 HIRL 0.6% up SE **IAP**
**RWY 11L:** MALSR. Rgt tfc. Arresting device.
**RWY 29R:** VASI(V6L)—Upper GA 3.25°TCH 94'. Lower GA 3.0°TCH 50'. Arresting device.
**RWY 11R-29L:** H9129X75 (ASPH) S-120, D-140, DT-220 0.6% up SE
**RWY 11R:** Thld dsplcd 2143'. Rgt tfc. **RWY 29L:** Thld dsplcd 1782'. Pole.
**RWY 03-21:** H7000X150 (ASPH-PFC) S-105, D-137, DT-230, DDT-500 MIRL
**RWY 03:** Thld dsplcd 841'. Railroad.
**RWY 21:** REIL. VASI(V4L)—GA 3.0°TCH 50.3'. Tree. Rgt tfc. Arresting device.
**AIRPORT REMARKS:** Attended continuously. Commercial ldg fee and tiedown fee. Acft departing Rwy 11R reqd to attain at least 400'AGL prior to starting turn. Southeast 1002' and northwest 3257' paved stopway Rwy 11L–29R. Rwy 11L–29R and 03–21 both sides have distance remaining markers. Rwy 11L-29R gross weight limit DC-10-10 315,000 lbs, DC-10-30/40 400,000 lbs, L-1011-1 325,000 lbs, L-1011-100/200 340,000 lbs, Rwy 03-21 gross weight limit DC-10-10 300,000 lbs, DC-10-30/40 375,000 lbs, L-1011-01 310,000 lbs, L-1011-100/200 315,000 lbs. Flight Notification Service (ADCUS) available.
**WEATHER DATA SOURCES:** LLWAS.
**COMMUNICATIONS: ATIS** 123.8 (602–741–1177) **UNICOM** 122.95
**TUCSON FSS** (TUS) on arpt. LC 889–9689. 122.2 NOTAM FILE TUS.
**MOUNT LEMON RCO** 122.4 (TUCSON FSS)
Ⓡ **APP/DEP CON** 125.1 (Rwy 11 090°–285°) (Rwy 29 275°–065°) 118.5 (Rwy 11 286°–089°) (Rwy 29 066°–274°) 128.5 (1300–0700Z) 118.3 (0700–1300)
**TOWER** 118.3 119.0 **GND CON** 124.4 **CLNC DEL** 126.65
**RADIO AIDS TO NAVIGATION:** NOTAM FILE TUS. VHF/DF ctc TUCSON FSS
**(H) VORTAC** 116.0 TUS Chan 107 32°05'42"N 110°54'51"W 301° 1.8 NM to fld. 2670/12E.
VORTAC unusable 050°-080° beyond 30 NM below 10,500' 350°-005° beyond 30 NM below 11,200'
**ILS/DME** 108.5 I-TUS Chan 22 Rwy 11L.

▼

| NAME | TAKE-OFF MINIMUMS |
|---|---|

TUCSON INTL
Rwys 3, 11L/R, 21, 29L/R, 4000-3 or standard with minimum climb of 250' per NM to 6500.
IFR DEPARTURE PROCEDURE: Comply with SID or radar vectors; or turn left or right as assigned by ATC direct TUS VORTAC, climb in holding pattern (NW, right turn, 128 inbound) to depart TUS VORTAC at or above MCA or MEA for assigned airway.

FIGURE 7.—Tucson Two Departure (Pilot Nav).


(DOWNE.DOWNE 2) 87267
DOWNE TWO ARRIVAL
LOS ANGELES INTERNATIONAL
LOS ANGELES, CALIFORNIA
NOTE: Chart not to scale
PEACH SPRINGS 112.0 PGS 57 35°37.5'N-113°32.6'W L-4-5, H-2
TWENTYNINE PALMS 114.2 TNP 89 34°06.7'N-115°46.1'W L-3, H-2
HECTOR 112.7 HEC 74 34°47.8'N-116°27.7'W L-3, H-2
FL 230 229° (120)
ABREE
DIKES
EMMEY
FL 230
14000 254° (48)
PIONE
14000 229°
248° (25)
10500 211° (66)
RUSTT
CIVET
R-030
R-046
PARADISE 112.2 PDZ 59
N
Cross at 250K or as assigned by ATC
7000 248° (29)
BASET
R-003
R-327
SEAL BEACH 115.7 SLI 104
DOWNE I-LAX-15 DME 33°57.8'N 118°07.5'W
265° (17)
R-068
R-085
SANTA MONICA 110.8 SMO 45
LOCALIZER 109.9 I-LAX 36
LOS ANGELES 113.6 LAX 83
239° (19)
WAKER
R-158
FILLMORE 112.5 FIM 72
(NARRATIVE ON FOLLOWING PAGE)
DOWNE TWO ARRIVAL
(DOWNE.DOWNE2)
LOS ANGELES, CALIFORNIA
LOS ANGELES INTERNATIONAL

(DOWNE.DOWNE2)

**DOWNE TWO ARRIVAL**

LOS ANGELES INTERNATIONAL
LOS ANGELES, CALIFORNIA

### ARRIVAL DESCRIPTION

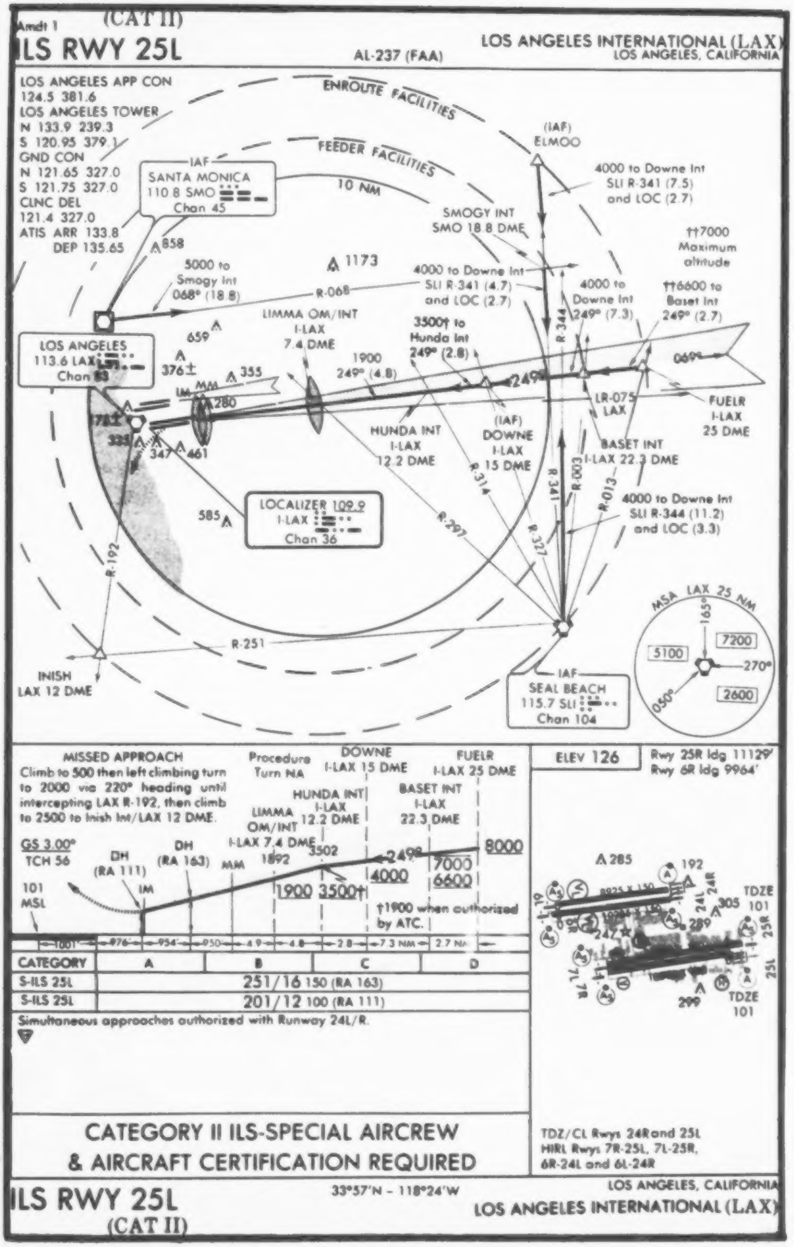
TWENTYNINE PALMS TRANSITION (TNP.DOWNE2): From over TWENTYNINE PALMS VORTAC via TWENTYNINE PALMS R-254 to PIONE DME, then LOS ANGELES R-068 to DOWNE INT. Thence....

HECTOR TRANSITION (HEC.DOWNE2): From over HECTOR VORTAC via HECTOR R-211 and PARADISE R-030 to CIVET INT, then LOS ANGELES R-068 to DOWNE INT. Thence....

PEACH SPRINGS TRANSITION (PGS. DOWNE2): From over PEACH SPRINGS VORTAC via PEACH SPRINGS R-229 and PARADISE R-046 to RUSTT INT, then LOS ANGELES R-068 to DOWNE INT. Thence....

....From DOWNE INT via SMO R-085 to SMO VOR/DME, then via SMO R-259 to WAKER INT, expect vector to final approach course.

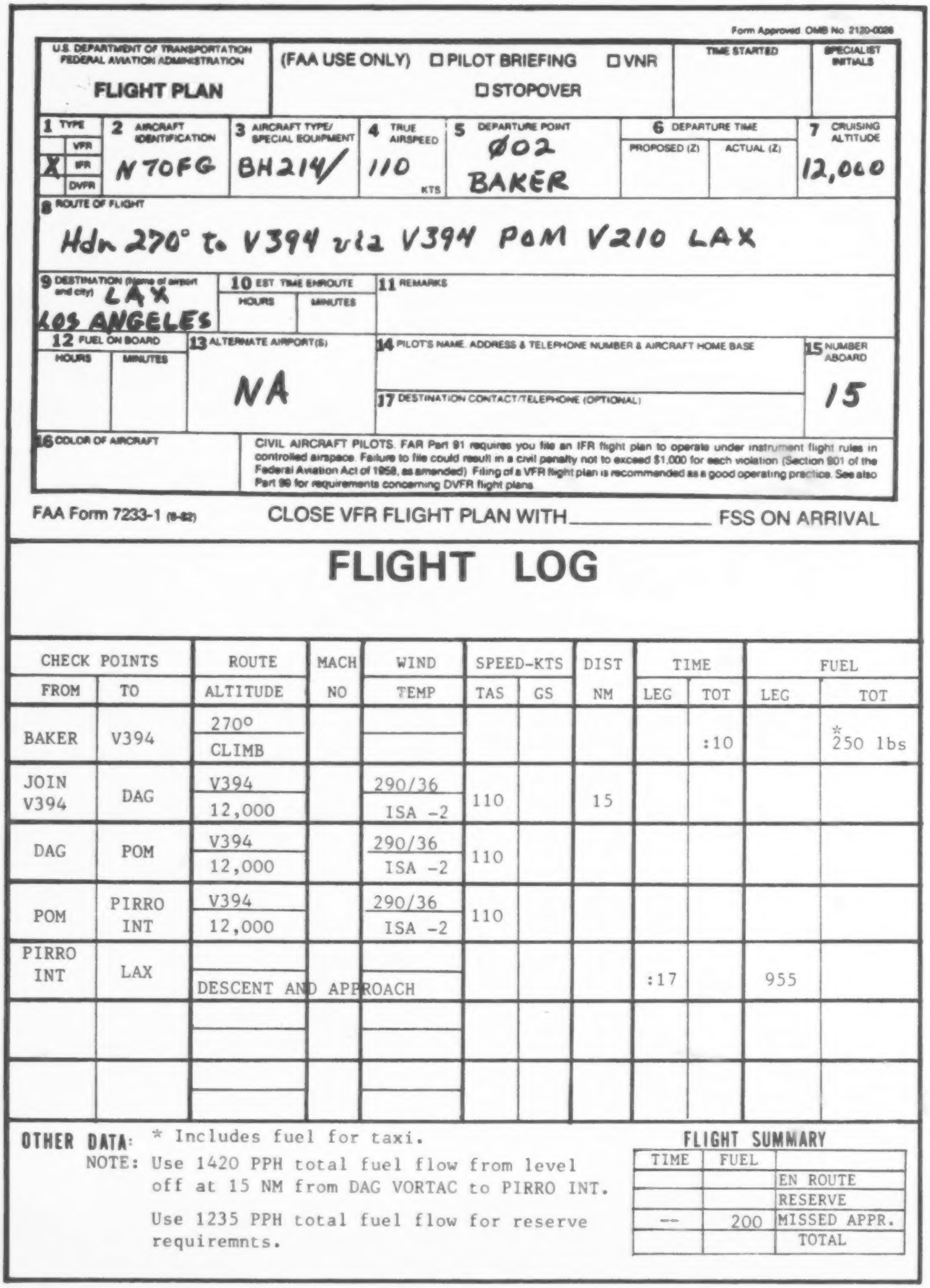
FIGURE 8.—Downe Two Arrival (Downe.Downe2).


Amdt 1 (CAT II)
ILS RWY 25L
AL-237 (FAA)
LOS ANGELES INTERNATIONAL (LAX)
LOS ANGELES, CALIFORNIA
LOS ANGELES APP CON 124.5 381.6
LOS ANGELES TOWER N 133.9 239.3 S 120.95 379.1
GND CON N 121.65 327.0 S 121.75 327.0
CLNC DEL 121.4 327.0
ATIS ARR 133.8 DEP 135.65
ENROUTE FACILITIES
FEEDER FACILITIES
10 NM
IAF SANTA MONICA 110.8 SMO Chan 45
(IAF) ELMOO
4000 to Downe Int SLI R-341 (7.5) and LOC (2.7)
SMOGY INT SMO 18.8 DME
††7000 Maximum altitude
5000 to Smogy Int 068° (18.8)
R-068
1173
4000 to Downe Int SLI R-341 (4.7) and LOC (2.7)
4000 to Downe Int 249° (7.3)
††6600 to Baset Int 249° (2.7)
LIMMA OM/INT I-LAX 7.4 DME
3500† to Hunda Int 249° (2.8)
1900 249° (4.8)
LOS ANGELES 113.6 LAX Chan 83
659
376
355
IM MM
280
069°
249°
LR-075 LAX
FUELR I-LAX 25 DME
HUNDA INT I-LAX 12.2 DME
(IAF) DOWNE I-LAX 15 DME
BASET INT I-LAX 22.3 DME
4000 to Downe Int SLI R-344 (11.2) and LOC (3.3)
R-344
R-341
R-003
R-013
R-314
R-297
R-327
LOCALIZER 109.9 I-LAX Chan 36
585
347
461
858
R-192
R-251
INISH LAX 12 DME
IAF SEAL BEACH 115.7 SLI Chan 104
MSA LAX 25 NM
165°
270°
050°
7200
5100
2600
MISSED APPROACH
Climb to 500 then left climbing turn to 2000 via 220° heading until intercepting LAX R-192, then climb to 2500 to Inish Int/LAX 12 DME.
Procedure Turn NA
DOWNE I-LAX 15 DME
FUELR I-LAX 25 DME
HUNDA INT I-LAX 12.2 DME
BASET INT I-LAX 22.3 DME
LIMMA OM/INT I-LAX 7.4 DME
GS 3.00° TCH 56
DH (RA 111)
DH (RA 163)
IM MM
101 MSL
1892
3502
249°
8000
1900
3500†
4000
7000
6600
†1900 when authorized by ATC.
1001'
976'
954'
950'
4.9
4.8
2.8
7.3 NM
2.7 NM
CATEGORY A B C D
S-ILS 25L 251/16 150 (RA 163)
S-ILS 25L 201/12 100 (RA 111)
Simultaneous approaches authorized with Runway 24L/R.
ELEV 126
Rwy 25R ldg 11129'
Rwy 6R ldg 9964'
285
192
305
289
247
299
TDZE 101
TDZE 101
24R
24L
25R
25L
7L
7R
CATEGORY II ILS-SPECIAL AIRCREW & AIRCRAFT CERTIFICATION REQUIRED
TDZ/CL Rwys 24R and 25L
HIRL Rwys 7R-25L, 7L-25R, 6R-24L and 6L-24R
ILS RWY 25L (CAT II)
33°57'N - 118°24'W
LOS ANGELES, CALIFORNIA
LOS ANGELES INTERNATIONAL (LAX)

## HELIPORTS

**LOS ANGELES INTL** (LAX) 9 SW UTC–8(–7DT) 33°56'33"N 118°24'26"W **LOS ANGELES COPTER**
126 B S4 **FUEL** 100, JET A OX 4 LRA CFR Index E
**RWY H2:** H60X60 (CONC) S-18, D-30 MIRL
**RWY H3:** H63X63 (CONC) S–15 LIRL
**AIRPORT REMARKS:** Attended continuously. CAUTION: Turbulence may be deflected upward from the blast fence located 160' east of Rwy 25R. Noise sensitive arpt. Numerous birds on and in vicinity of arpt. Flight Notification Service (ADCUS) available. Rwy H2 lgtd on req to USCG. Ovrngt tiedown fee. Rwy H3 ctc twr for tfc pattern.
**WEATHER DATA SOURCES:** LLWAS
**COMMUNICATIONS: ATIS ARRIVAL** 133.8 **ATIS DEP** 135.65 (213) 646–2297 **UNICOM** 122.95
**HAWTHORNE FSS** (HHR) LC 644-1020. NOTAM FILE LAX.
**TOWER** 120.35 (Helicopters east) 119.8 (Helicopters west) **GND CON** 121.75 (S. complex) 121.65 (N. complex) **CLNC DEL** 121.4
**TCA Group I:** See VFR Terminal Area chart.

FIGURE 9.—ILS RWY 25L (CAT II) - Los Angeles International (LAX).



Form Approved OMB No. 2120-0026

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

**FLIGHT PLAN**

(FAA USE ONLY) ☐ PILOT BRIEFING ☐ VNR ☐ STOPOVER

TIME STARTED

SPECIALIST INITIALS

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 TYPE<br>☐ VFR<br>☒ IFR<br>☐ DVFR | 2 AIRCRAFT IDENTIFICATION<br>N70FG | 3 AIRCRAFT TYPE/ SPECIAL EQUIPMENT<br>BH214/ | 4 TRUE AIRSPEED<br>110 KTS | 5 DEPARTURE POINT<br>002<br>BAKER | 6 DEPARTURE TIME<br>PROPOSED (Z)<br>ACTUAL (Z) | 7 CRUISING ALTITUDE<br>12,000 |

8 ROUTE OF FLIGHT
Hdn 270° to V394 via V394 POM V210 LAX

9 DESTINATION (Name of airport and city) LAX LOS ANGELES

10 EST. TIME ENROUTE HOURS MINUTES

11 REMARKS

12 FUEL ON BOARD HOURS MINUTES

13 ALTERNATE AIRPORT(S) NA

14 PILOT'S NAME, ADDRESS & TELEPHONE NUMBER & AIRCRAFT HOME BASE

15 NUMBER ABOARD 15

16 COLOR OF AIRCRAFT

17 DESTINATION CONTACT/TELEPHONE (OPTIONAL)

CIVIL AIRCRAFT PILOTS. FAR Part 91 requires you file an IFR flight plan to operate under instrument flight rules in controlled airspace. Failure to file could result in a civil penalty not to exceed $1,000 for each violation (Section 901 of the Federal Aviation Act of 1958, as amended). Filing of a VFR flight plan is recommended as a good operating practice. See also Part 99 for requirements concerning DVFR flight plans.

FAA Form 7233-1 (8-82)   CLOSE VFR FLIGHT PLAN WITH ____________ FSS ON ARRIVAL

## FLIGHT LOG

| CHECK POINTS | | ROUTE | MACH | WIND | SPEED-KTS | | DIST | TIME | | FUEL | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM | TO | ALTITUDE | NO | TEMP | TAS | GS | NM | LEG | TOT | LEG | TOT |
| BAKER | V394 | 270°<br>CLIMB | | | | | | | :10 | | *250 lbs |
| JOIN V394 | DAG | V394<br>12,000 | | 290/36<br>ISA -2 | 110 | | 15 | | | | |
| DAG | POM | V394<br>12,000 | | 290/36<br>ISA -2 | 110 | | | | | | |
| POM | PIRRO INT | V394<br>12,000 | | 290/36<br>ISA -2 | 110 | | | | | | |
| PIRRO INT | LAX | DESCENT AND APPROACH | | | | | | :17 | | 955 | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

**OTHER DATA:** * Includes fuel for taxi.

NOTE: Use 1420 PPH total fuel flow from level off at 15 NM from DAG VORTAC to PIRRO INT.

Use 1235 PPH total fuel flow for reserve requiremnts.

**FLIGHT SUMMARY**

| TIME | FUEL | |
|---|---|---|
| | | EN ROUTE |
| | | RESERVE |
| -- | 200 | MISSED APPR. |
| | | TOTAL |

FIGURE 10.—Flight Plan/Flight Log.

190

191

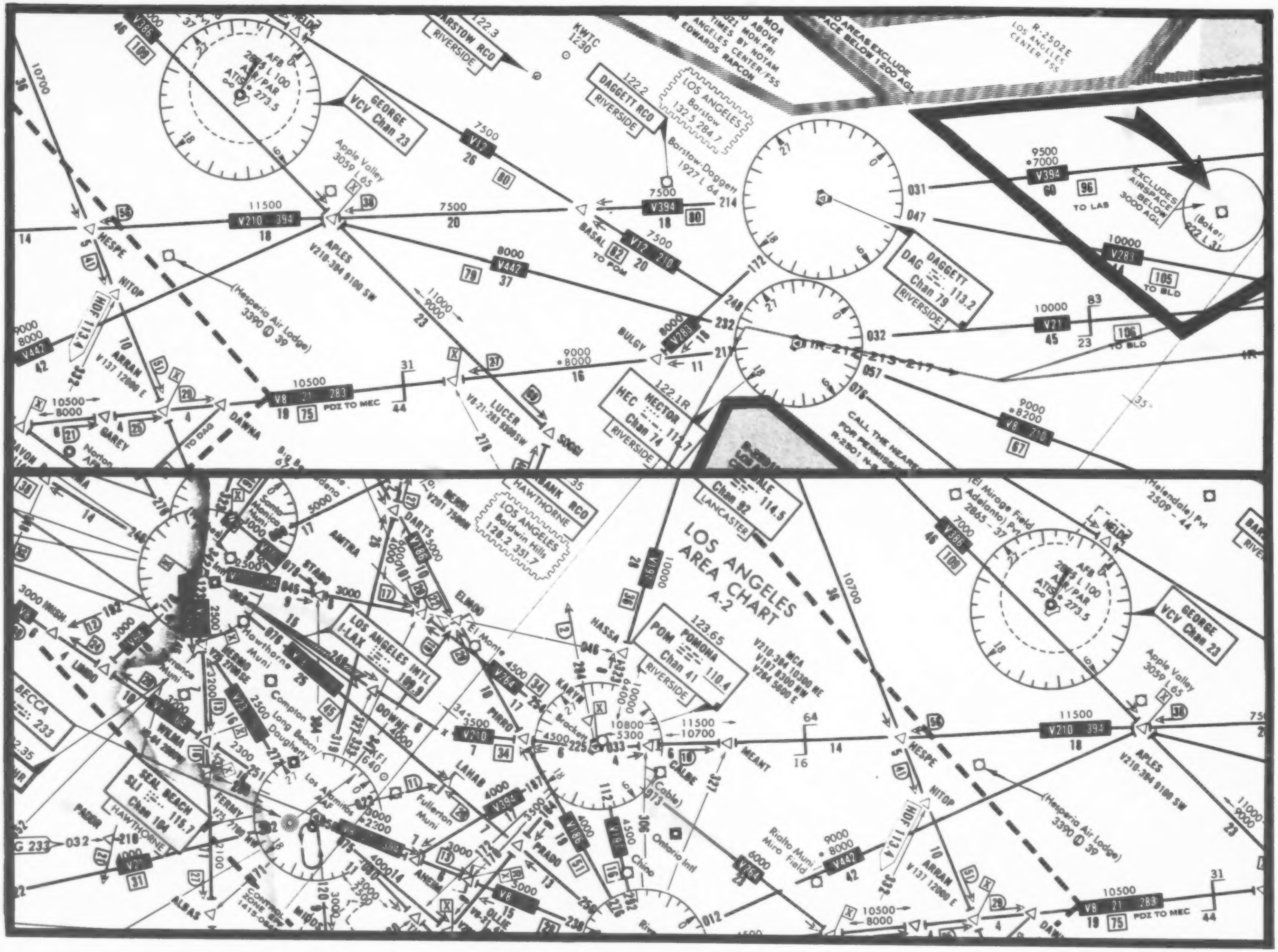
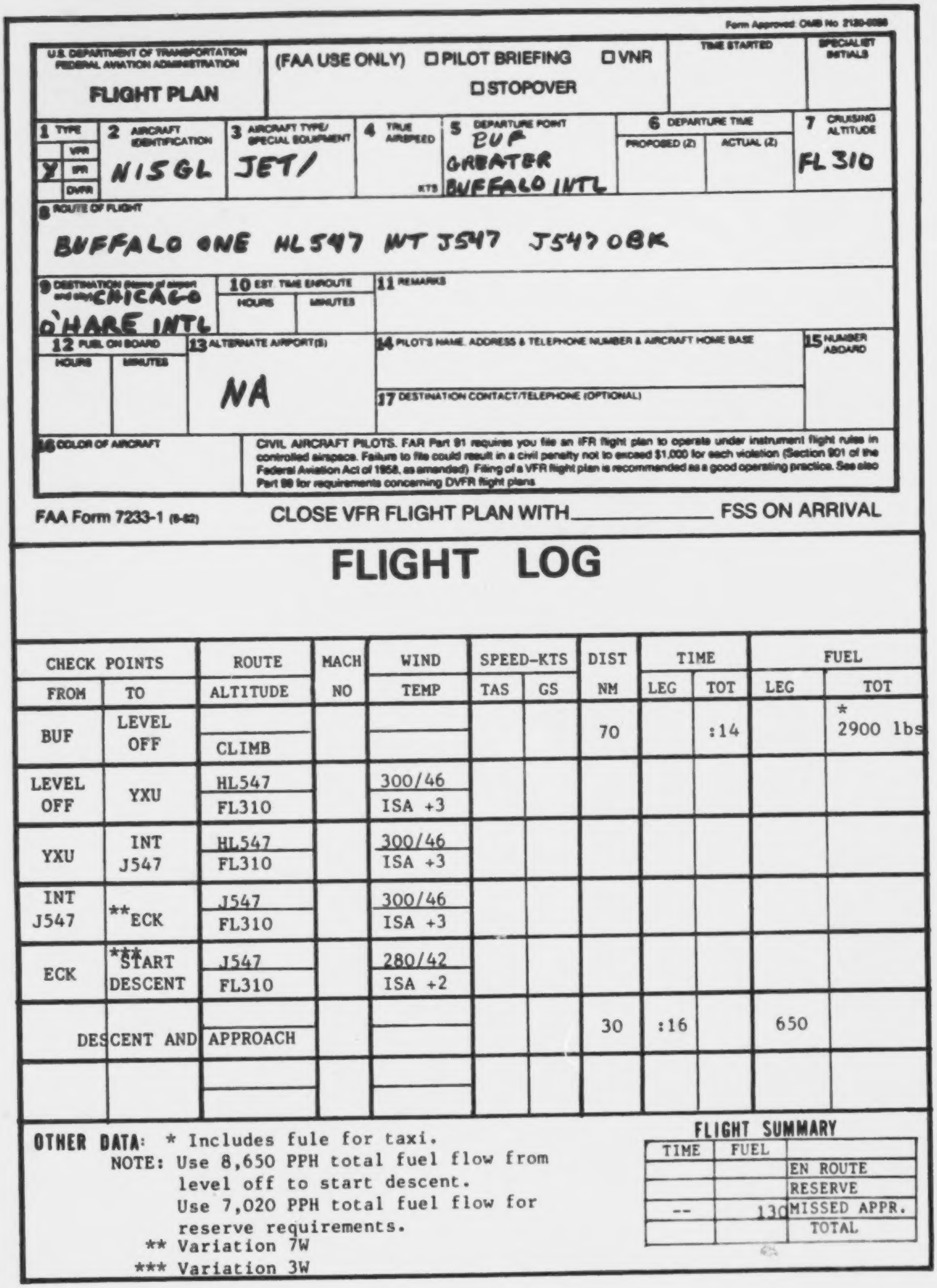

GEORGE
VCV Chan 23
Apple Valley
3059 L 65
V210 394
11500
18
14
HESPE
NITOP
APLES
V210-394 8100 SW
V12
7500
26
80
V394
7500
18
80
214
BASAL
TO POM
V12 210
7500
20
8000
V442
37
79
DAGGETT RCO
122.2
RIVERSIDE
LOS ANGELES
Barstow
132.5 284.7
Barstow-Daggett
1927 L 64
DAGGETT
DAG 113.2
Chan 79
RIVERSIDE
031
047
9500
7000
V394
60
96
TO LAS
EXCLUDES
AIRSPACE
BELOW
3000 AGL
(Baker)
922 L 31
10000
V283
105
TO BLD
10000
V21
45
83
23
106
TO BLD
032
057
076
IR-212-213-217
9000
8200
V8 210
67
CALL THE NEAREST
FOR PERMISSION
R-2501 N-S
R-2502 E
LOS ANGELES
CENTER FSS
MOA
ABOVE
MON-FRI
TIMES BY NOTAM
LOS ANGELES CENTER/FSS
EDWARDS RAPCON
AREAS EXCLUDE
AIRSPACE BELOW 1200 AGL
KWTC
1230
BARSTOW RCO
122.3
RIVERSIDE
AFB
2875 L 100
ASR/PAR
ATIS 273.5
V386
7000
46
108
10700
36
9000
8000
V442
42
HDF 113.4
ARRAN
V137 12000 E
(Hesperia Air Lodge)
3390 39
11000
9000
23
10500
V8 21 283
19
75
PDZ TO MEC
31
44
10500
8000
GAREY
DAWNA
TO DAG
LUCER
V8-21-283 8300SW
SOGGI
9000
8000
16
11
BULGY
8000
V283
232
248
172
217
HECTOR
HEC 112.7
Chan 74
RIVERSIDE
122.1R
PALMDALE
PMD 114.5
Chan 92
LANCASTER
LOS ANGELES
AREA CHART
A-2
V197
10000
POMONA
POM 110.4
Chan 41
123.65
RIVERSIDE
MCA
V210-394 10300 NE
V197 8300 NW
V264 5600 E
BURBANK RCO
HAWTHORNE
LOS ANGELES
Baldwin Hills
128.2 351.7
BERRI
V201 7500NE
DARTS
V186
ELMOO
El Monte
V264
4500
PIRRO
Brackett
HASSA
KARTH
10800
5300
11500
10700
64
16
14
MEANT
CALBE
Cable
Ontario Intl
Chino
Rialto Muni
Miro Field
V264
6000
V442
9000
8000
42
10500
8000
LOS ANGELES INTL
I-LAX
AMTRA
STABO
3000
Hawthorne Muni
Compton
Long Beach/
Daugherty
Torrance Muni
WILMA
SEAL BEACH
SLI 115.7
Chan 104
HAWTHORNE
V23
Los Alamitos AAF
Fullerton Muni
LAHAB
V394
4000
PRADO
V186
V197
V8
5000
OLLIE
ANGIN
FERMY
PARDI
ALBAS
CONTROL ZONE
BECCA
233
LIMBO
Santa Monica Muni
Bell
V210
3500
DOWNE
(El Mirage Field
Adelanto) Pvt
2865 - 37
(Helendale) Pvt
2509 - 44
HELEN
G 233
032
218
V27
31
5000
12
24
21

FIGURE 11.—En Route Low Altitude Chart Segment.

192



Form Approved: OMB No 2120-0026

| | | | |
|---|---|---|---|
| U.S. DEPARTMENT OF TRANSPORTATION<br>FEDERAL AVIATION ADMINISTRATION<br>**FLIGHT PLAN** | (FAA USE ONLY) ☐ PILOT BRIEFING ☐ VNR<br>☐ STOPOVER | TIME STARTED | SPECIALIST INITIALS |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 TYPE<br>VFR<br>[✓ IFR]<br>DVFR | 2 AIRCRAFT IDENTIFICATION<br>N15GL | 3 AIRCRAFT TYPE/ SPECIAL EQUIPMENT<br>JET/ | 4 TRUE AIRSPEED<br>KTS | 5 DEPARTURE POINT<br>BUF<br>GREATER<br>BUFFALO INTL | 6 DEPARTURE TIME<br>PROPOSED (Z) ACTUAL (Z) | 7 CRUISING ALTITUDE<br>FL 310 |

8 ROUTE OF FLIGHT

BUFFALO ONE HL547 WT J547 J547 OBK

| | | |
|---|---|---|
| 9 DESTINATION (Name of airport and city) CHICAGO O'HARE INTL | 10 EST. TIME ENROUTE<br>HOURS MINUTES | 11 REMARKS |

| | | | |
|---|---|---|---|
| 12 FUEL ON BOARD<br>HOURS MINUTES | 13 ALTERNATE AIRPORT(S)<br>NA | 14 PILOT'S NAME, ADDRESS & TELEPHONE NUMBER & AIRCRAFT HOME BASE<br>17 DESTINATION CONTACT/TELEPHONE (OPTIONAL) | 15 NUMBER ABOARD |
| 16 COLOR OF AIRCRAFT | | CIVIL AIRCRAFT PILOTS. FAR Part 91 requires you file an IFR flight plan to operate under instrument flight rules in controlled airspace. Failure to file could result in a civil penalty not to exceed $1,000 for each violation (Section 901 of the Federal Aviation Act of 1958, as amended). Filing of a VFR flight plan is recommended as a good operating practice. See also Part 99 for requirements concerning DVFR flight plans. | |

FAA Form 7233-1 (8-82) CLOSE VFR FLIGHT PLAN WITH ____________ FSS ON ARRIVAL

## FLIGHT LOG

| CHECK POINTS | | ROUTE | MACH | WIND | SPEED-KTS | | DIST | TIME | | FUEL | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM | TO | ALTITUDE | NO | TEMP | TAS | GS | NM | LEG | TOT | LEG | TOT |
| BUF | LEVEL OFF | CLIMB | | | | | 70 | | :14 | | * 2900 lbs |
| LEVEL OFF | YXU | HL547<br>FL310 | | 300/46<br>ISA +3 | | | | | | | |
| YXU | INT J547 | HL547<br>FL310 | | 300/46<br>ISA +3 | | | | | | | |
| INT J547 | **ECK | J547<br>FL310 | | 300/46<br>ISA +3 | | | | | | | |
| ECK | ***START DESCENT | J547<br>FL310 | | 280/42<br>ISA +2 | | | | | | | |
| DESCENT AND APPROACH | | | | | | | 30 | :16 | | 650 | |
| | | | | | | | | | | | |

**OTHER DATA:** * Includes fule for taxi.
NOTE: Use 8,650 PPH total fuel flow from level off to start descent.
Use 7,020 PPH total fuel flow for reserve requirements.
** Variation 7W
*** Variation 3W

**FLIGHT SUMMARY**

| TIME | FUEL | |
|---|---|---|
| | | EN ROUTE |
| | | RESERVE |
| -- | 130 | MISSED APPR. |
| | | TOTAL |

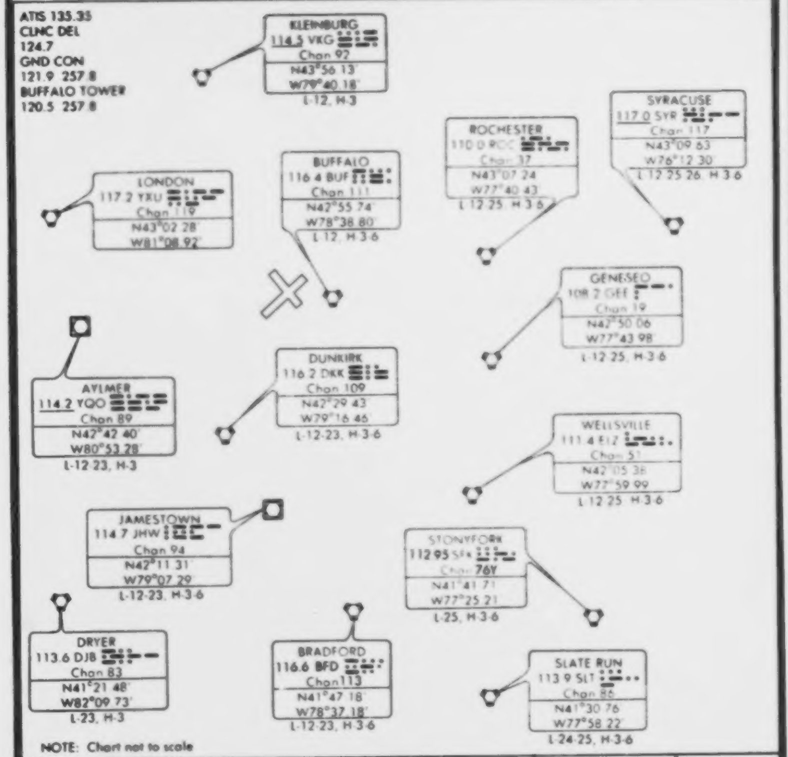
FIGURE 12.—Flight Plan/Flight Log.

37323

## BUFFALO ONE DEPARTURE (VECTOR)

BUFFALO/GREATER BUFFALO INTL
BUFFALO, NEW YORK

ATIS 135.35
CLNC DEL
124.7
GND CON
121.9 257.8
BUFFALO TOWER
120.5 257.8


KLEINBURG
114.5 VKG
Chan 92
N43°56.13'
W79°40.18'
L-12, H-3
SYRACUSE
117.0 SYR
Chan 117
N43°09.63'
W76°12.30'
L-12-25-26, H-3-6
ROCHESTER
110.0 ROC
Chan 37
N43°07.24'
W77°40.43'
L-12-25, H-3-6
BUFFALO
116.4 BUF
Chan 111
N42°55.74'
W78°38.80'
L-12, H-3-6
LONDON
117.2 YXU
Chan 119
N43°02.28'
W81°08.92'
GENESEO
108.2 GEE
Chan 19
N42°50.06'
W77°43.98'
L-12-25, H-3-6
AYLMER
114.2 YQO
Chan 89
N42°42.40'
W80°53.28'
L-12-23, H-3
DUNKIRK
116.2 DKK
Chan 109
N42°29.43'
W79°16.46'
L-12-23, H-3-6
WELLSVILLE
111.4 ELZ
Chan 51
N42°05.38'
W77°59.99'
L-12-25, H-3-6
JAMESTOWN
114.7 JHW
Chan 94
N42°11.31'
W79°07.29'
L-12-23, H-3-6
STONYFORK
112.95 SFK
Chan 76Y
N41°41.71'
W77°25.21'
L-25, H-3-6
DRYER
113.6 DJB
Chan 83
N41°21.48'
W82°09.73'
L-23, H-3
BRADFORD
116.6 BFD
Chan 113
N41°47.18'
W78°37.18'
L-12-23, H-3-6
SLATE RUN
113.9 SLT
Chan 86
N41°30.76'
W77°58.22'
L-24-25, H-3-6

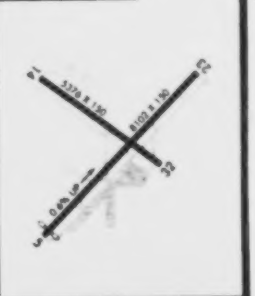
NOTE: Chart not to scale

### DEPARTURE ROUTE DESCRIPTION

All aircraft cleared as filed. Expect vectors to filed route or depicted fix. Maintain 10,000′ or assigned lower altitude. Expect further clearance to requested altitude/flight level ten minutes after departure.

All Runways: Maintain runway heading for vectors.

ELEV 724


14
5376 X 150
8102 X 150
23
32
0.6% UP
5

BUFFALO ONE DEPARTURE (VECTOR)

BUFFALO, NEW YORK
BUFFALO/GREATER BUFFALO INTL

## NEW YORK

### BUFFALO

§ **BUFFALO AIRFIELD** (9G0) 6.1 SE UTC–5(–4DT) 42°51′40″N 78°43′00″W **DETROIT**
670 B S2 **FUEL** 80, 100LL **L-12H**
**RWY 06-24:** H2665X60 (ASPH) S-8 MIRL **IAP**
**RWY 06:** Trees. **RWY 24:** Tree.
**AIRPORT REMARKS:** Attended daylight hours. CAUTION: Ultralight activity on arpt. Airport lgts opr dusk-0700Z‡. For runway lights after 0700Z‡ phone 716-668-4900.
**COMMUNICATIONS: CTAF/UNICOM** 122.8
**BUFFALO FSS** (BUF) LC 631-9830. NOTAM FILE BUF.
Ⓡ **BUFFALO APP DEP/CON** 123.8
**RADIO AIDS TO NAVIGATION:** NOTAM FILE BUF.
**BUFFALO (H) VORTAC** 116.4 BUF Chan 111 42°55′44″N 78°38′48″W 225° 4.9 NM to fld. 730/08W.

---

§ **GREATER BUFFALO INTL** (BUF) 5.2 E UTC–5(–4DT) 42°56′26″N 78°43′57″W **DETROIT**
724 B S4 **FUEL** 100LL, JET A OX 1, 2, 3, 4 LRA CFR Index D **H-3C, 6I, L-12H**
**RWY 05-23:** H8102X150 (ASPH-GRVD) S–75, D–195, DT–450 HIRL CL 0.6% up NE **IAP**
**RWY 05:** SSALR. TDZ. Thld dsplcd 335′. Pole. **RWY 23:** SSALR. TDZ.
**RWY 14-32:** H5376X150 (ASPH) S-75, D-100, DT-160 MIRL 0.3% up SE.
**RWY 14:** VASI(V4L)—GA 3.0° TCH 55′. Tree. **RWY 32:** REIL. VASI(V4L)—GA 3.0° TCH 55′. Fence.
**AIRPORT REMARKS:** Attended continuously. Landing fee. CAUTION-Jet engine test stand located approximately 3600′ from approach end Rwy 32 1400′ south center line . Jet exhaust may reach altitude 100′ AGL. Ops conducted occasionally 1300-2300Z‡. CAUTION: Numerous types of birds may be encountered in holding pattern over Grand Island up to 5000′. Heavy concentration of Gulls, Blackbirds, and Starlings up to 5000′ on and in vicinity of arpt. Deer on and in vicinity of arpt. Flight Notification Service (ADCUS) available.
**WEATHER DATA SOURCES:** LLWAS.
**COMMUNICATIONS: ATIS** 135.35 **UNICOM** 122.95
**BUFFALO FSS** (BUF) on arpt. 122.6 122.2 122.1R 116.4T DL NOTAM FILE BUF.
Ⓡ **BUFFALO APP DEP/CON** 123.8 (055°-194°) 126.5 (195°-279°) 126.15 (280°-054°)
**BUFFALO TOWER** 120.5 **GND CON** 121.9
**CLNC DEL** 124.7 **PRE-TAXI CLNC** 124.7
**ARSA** ctc **APP CON**
**RADIO AIDS TO NAVIGATION:** NOTAM FILE BUF.
**BUFFALO (H) VORTAC** 116.4 BUF Chan 111 42°55′44″N 78°38′48″W 288° 3.5 NM to fld. 730/08W.
**KLUMP NDB (LOM)** 231 BU 43°00′01″N 78°39′04″W 233° 4.4 NM to fld.
**PLAZZ NDB (LOM)** 204 GB 42°52′26″N 78°49′00″W 053° 4.8 NM to fld.
**ILS** 111.3 I-BUF Rwy 23 LOM KLUMP NDB. Inner marker out of svc indefinitely. Back course unusable beyond 15 NM.
**ILS** 108.5 I-GBI Rwy 05 LOM PLAZZ NDB.
**ASR**

FIGURE 13.—Buffalo One Departure (Vector) - Buffalo/Greater Buffalo Intl.

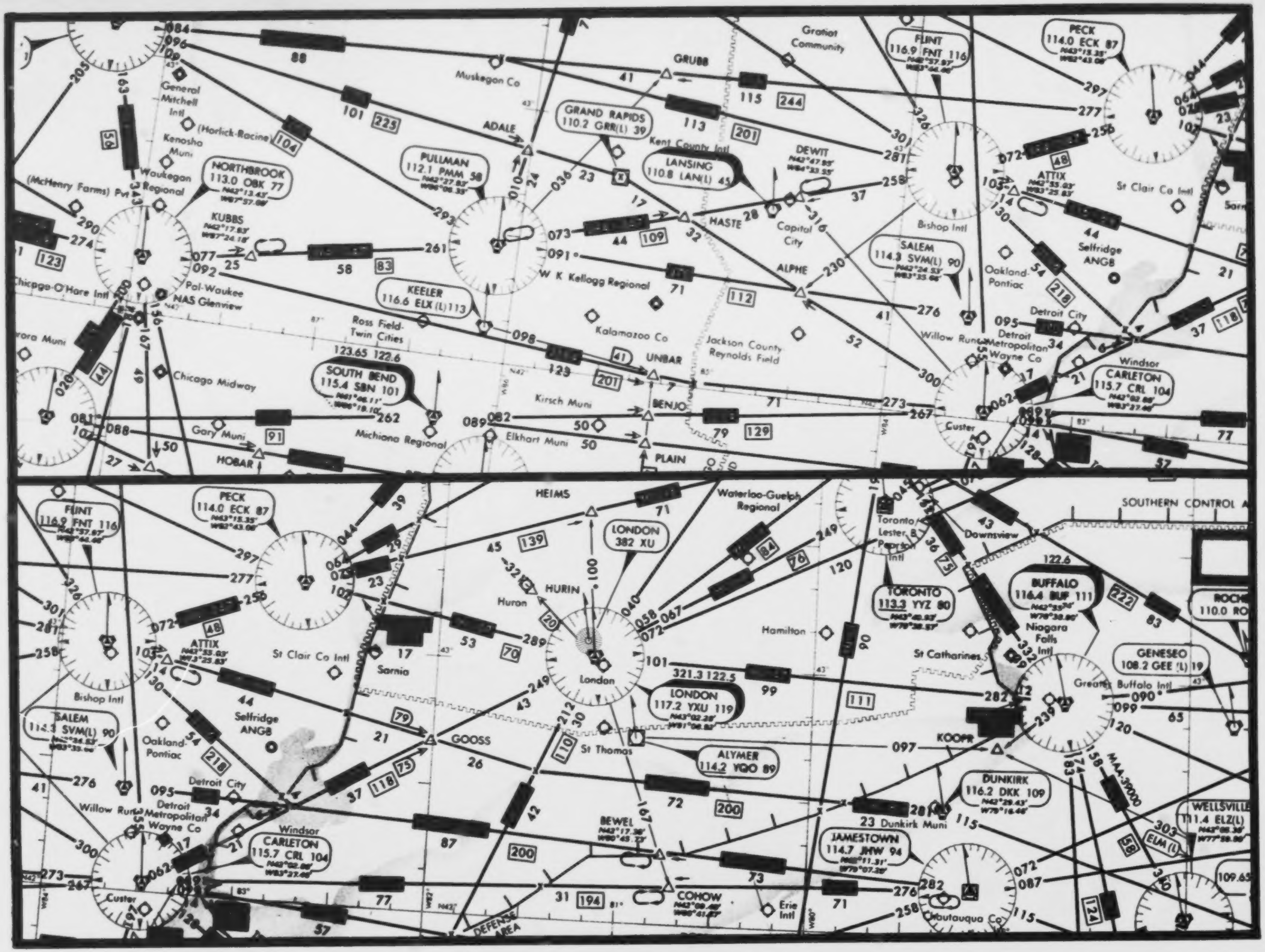

GRUBB
Gratiot Community
FLINT 116.9 FNT 116
PECK 114.0 ECK 87
Muskegon Co
General Mitchell Intl
(Horlick-Racine)
Kenosha Muni
Waukegan Regional
(McHenry Farms) Pvt
NORTHBROOK 113.0 OBK 77
GRAND RAPIDS 110.2 GRR(L) 39
Kent County Intl
ADALE
PULLMAN 112.1 PMM 58
LANSING 110.8 LAN(L) 45
DEWIT
HASTE
Capital City
Bishop Intl
ATTIX
St Clair Co Intl
Selfridge ANGB
KUBBS
Pal-Waukee
NAS Glenview
Chicago-O'Hare Intl
SALEM 114.3 SVM(L) 90
Oakland-Pontiac
ALPHE
W K Kellogg Regional
KEELER 116.6 ELX (L) 113
Ross Field-Twin Cities
Kalamazoo Co
Jackson County Reynolds Field
Detroit City
Willow Run
Detroit Metropolitan Wayne Co
Windsor
CARLETON 115.7 CRL 104
UNBAR
123.65 122.6
SOUTH BEND 115.4 SBN 101
Chicago Midway
Kirsch Muni
BENJO
Custer
Gary Muni
Michiana Regional
Elkhart Muni
HOBAR
PLAIN
HEIMS
Waterloo-Guelph Regional
Toronto/Lester B. Pearson Intl
Downsview
SOUTHERN CONTROL A
LONDON 382 XU
HURIN
Huron
TORONTO 113.3 YYZ 80
122.6
BUFFALO 116.4 BUF 111
Niagara Falls Intl
ROCH 110.0 RO
Hamilton
Sarnia
London
321.3 122.5
LONDON 117.2 YXU 119
St Catharines
GENESEO 108.2 GEE (L) 19
Greater Buffalo Intl
GOOSS
St Thomas
ALYMER 114.2 YQO 89
KOOPR
DUNKIRK 116.2 DKK 109
MAA-39000
WELLSVILLE 111.4 ELZ(L)
BEWEL
Dunkirk Muni
JAMESTOWN 114.7 JHW 94
COHOW
Erie Intl
Chautauqua Co
DEFENSE AREA
109.65

FIGURE 14.—IFR En Route High Altitude Chart Segment.

Form Approved OMB No 2120-0026

| | | | | | |
|---|---|---|---|---|---|
| U.S. DEPARTMENT OF TRANSPORTATION<br>FEDERAL AVIATION ADMINISTRATION<br>**FLIGHT PLAN** | (FAA USE ONLY) ☐ PILOT BRIEFING ☐ VNR<br>☐ STOPOVER | | | TIME STARTED | SPECIALIST INITIALS |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 TYPE<br>☐ VFR<br>☒ IFR<br>☐ DVFR | 2 AIRCRAFT IDENTIFICATION<br>N63SM | 3 AIRCRAFT TYPE/ SPECIAL EQUIPMENT<br>C402/R | 4 TRUE AIRSPEED<br>160<br>KTS | 5 DEPARTURE POINT<br>CHICAGO MIDWAY | 6 DEPARTURE TIME<br>PROPOSED (Z) | ACTUAL (Z) | 7 CRUISING ALTITUDE<br>FL180 |

8 ROUTE OF FLIGHT

CANAL THREE J146 SBN J554 CRL J586/HL 586 YXU HL547/J547 BUF

| | | | |
|---|---|---|---|
| 9 DESTINATION (Name of airport and city) GREATER BUFFALO | 10 EST. TIME ENROUTE<br>HOURS | MINUTES | 11 REMARKS |

| | | | | |
|---|---|---|---|---|
| 12 FUEL ON BOARD<br>HOURS | MINUTES | 13 ALTERNATE AIRPORT(S)<br>NA | 14 PILOT'S NAME, ADDRESS & TELEPHONE NUMBER & AIRCRAFT HOME BASE<br>17 DESTINATION CONTACT/TELEPHONE (OPTIONAL) | 15 NUMBER ABOARD |

16 COLOR OF AIRCRAFT

CIVIL AIRCRAFT PILOTS. FAR Part 91 requires you file an IFR flight plan to operate under instrument flight rules in controlled airspace. Failure to file could result in a civil penalty not to exceed $1,000 for each violation (Section 901 of the Federal Aviation Act of 1958, as amended). Filing of a VFR flight plan is recommended as a good operating practice. See also Part 99 for requirements concerning DVFR flight plans.

FAA Form 7233-1 (8-82) CLOSE VFR FLIGHT PLAN WITH ____________ FSS ON ARRIVAL

## FLIGHT LOG

| CHECK POINTS | | ROUTE | VAR | WIND | SPEED-KTS | | DIST | TIME | | FUEL | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM | TO | ALTITUDE | | TEMP | TAS | GS | NM | LEG | TOT | LEG | TOT |
| CANAL THREE | LEVEL OFF | <br>CLIMB | | | | | | | :18 | | *<br>105 lb. |
| LEVEL | SBN | J146<br>FL180 | 1W | 260/45<br>ISA | 160 | | 48 | | | | |
| SBN | CRL | J554<br>FL180 | 3W | 260/45<br>ISA | 160 | | | | | | |
| CRL | YXU | J586/HL586<br>FL180 | 6W | 285/43<br>ISA | 160 | | | | | | |
| YXU | START DESCENT | HL547/J547 | 8W | 285/43 | 160 | | | | | | |
| DESCENT AND | | APPROACH | | | | | 80 | :24 | | 85 | |
| | | | | | | | | | | | |

**OTHER DATA:** * Includes fuel for taxi.

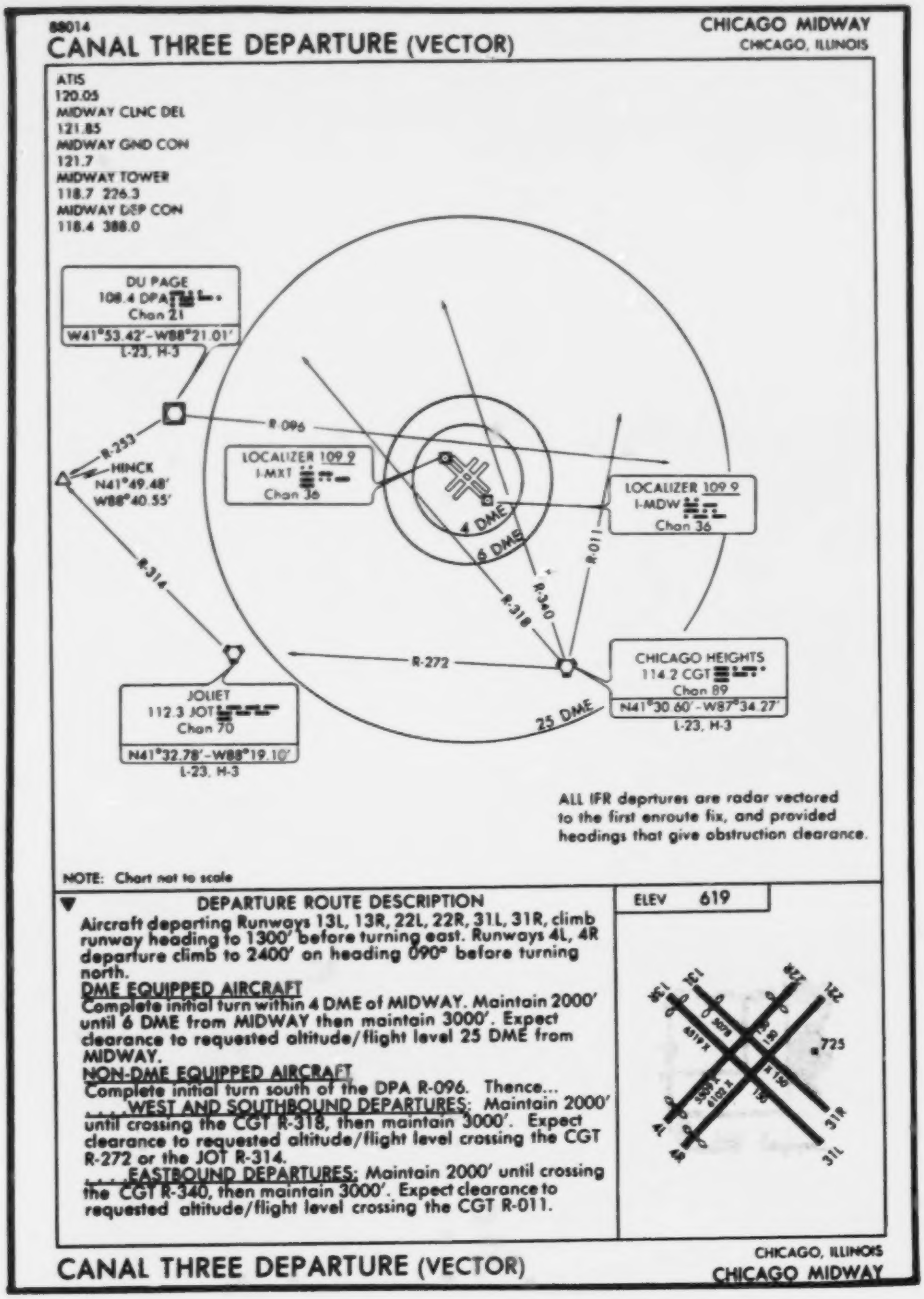
NOTE: Use 146 PPH fuel flow for cruise.

Use 136 PPH fuel flow for reserve requirements.

FLIGHT SUMMARY

| TIME | FUEL | |
|---|---|---|
| | | EN ROUTE |
| | | RESERVE |
| -- | 36 | MISSED APPR. |
| | | TOTAL |

FIGURE 15.—Flight Plan/Flight Log.



89014
CANAL THREE DEPARTURE (VECTOR)

CHICAGO MIDWAY
CHICAGO, ILLINOIS

ATIS
120.05
MIDWAY CLNC DEL
121.85
MIDWAY GND CON
121.7
MIDWAY TOWER
118.7 226.3
MIDWAY DEP CON
118.4 388.0

DU PAGE
108.4 DPA
Chan 21
W41°53.42′-W88°21.01′
L-23, H-3
R-096
R-253
HINCK
N41°49.48′
W88°40.55′
R-314
LOCALIZER 109.9
I-MXT
Chan 36
LOCALIZER 109.9
I-MDW
Chan 36
4 DME
6 DME
R-011
R-340
R-318
R-272
CHICAGO HEIGHTS
114.2 CGT
Chan 89
N41°30.60′-W87°34.27′
L-23, H-3
25 DME
JOLIET
112.3 JOT
Chan 70
N41°32.78′-W88°19.10′
L-23, H-3
ELEV 619
13L
13R
22L
22R
4L
4R
31R
31L
725

ALL IFR deprtures are radar vectored to the first enroute fix, and provided headings that give obstruction clearance.

NOTE: Chart not to scale

▼ DEPARTURE ROUTE DESCRIPTION

Aircraft departing Runways 13L, 13R, 22L, 22R, 31L, 31R, climb runway heading to 1300′ before turning east. Runways 4L, 4R departure climb to 2400′ on heading 090° before turning north.

DME EQUIPPED AIRCRAFT
Complete initial turn within 4 DME of MIDWAY. Maintain 2000′ until 6 DME from MIDWAY then maintain 3000′. Expect clearance to requested altitude/flight level 25 DME from MIDWAY.

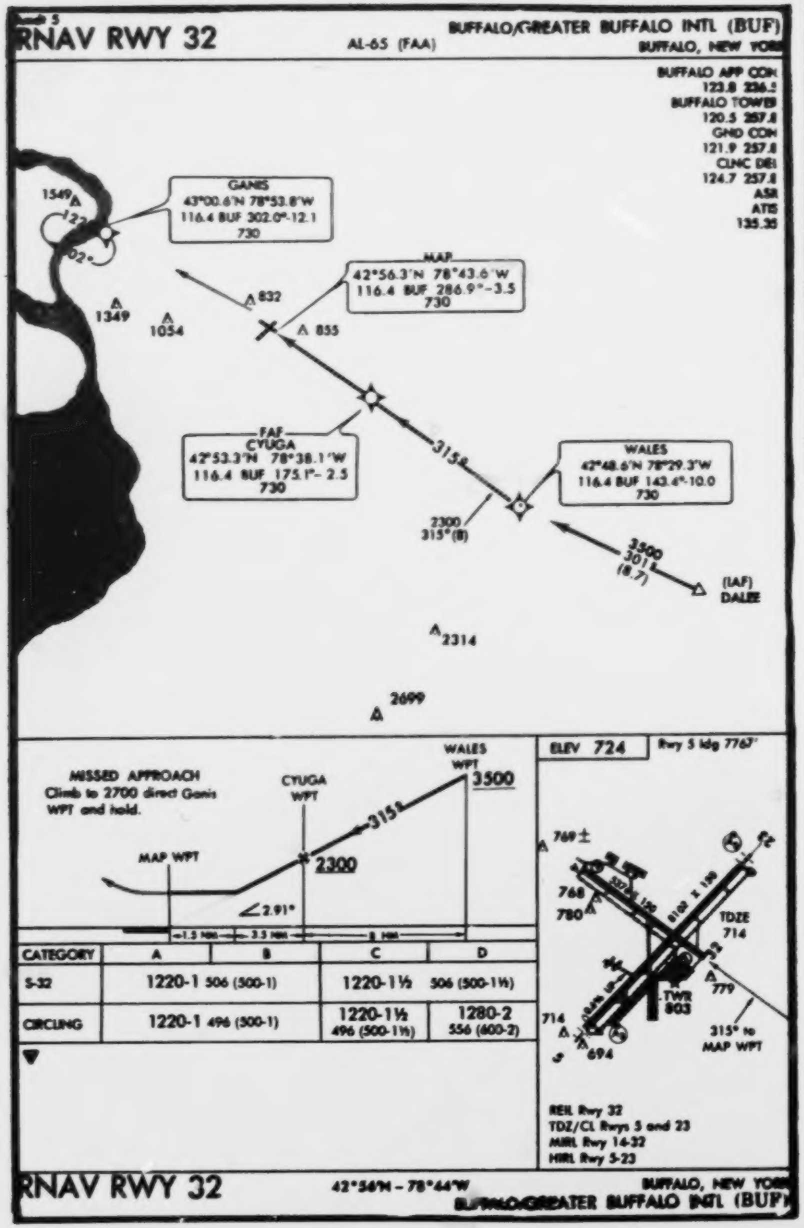
NON-DME EQUIPPED AIRCRAFT
Complete initial turn south of the DPA R-096. Thence...
. . . . WEST AND SOUTHBOUND DEPARTURES: Maintain 2000′ until crossing the CGT R-318, then maintain 3000′. Expect clearance to requested altitude/flight level crossing the CGT R-272 or the JOT R-314.
. . . . EASTBOUND DEPARTURES: Maintain 2000′ until crossing the CGT R-340, then maintain 3000′. Expect clearance to requested altitude/flight level crossing the CGT R-011.

CANAL THREE DEPARTURE (VECTOR)

CHICAGO, ILLINOIS
CHICAGO MIDWAY

FIGURE 16.—Canal Three Departure (Vector) - Chicago Midway.

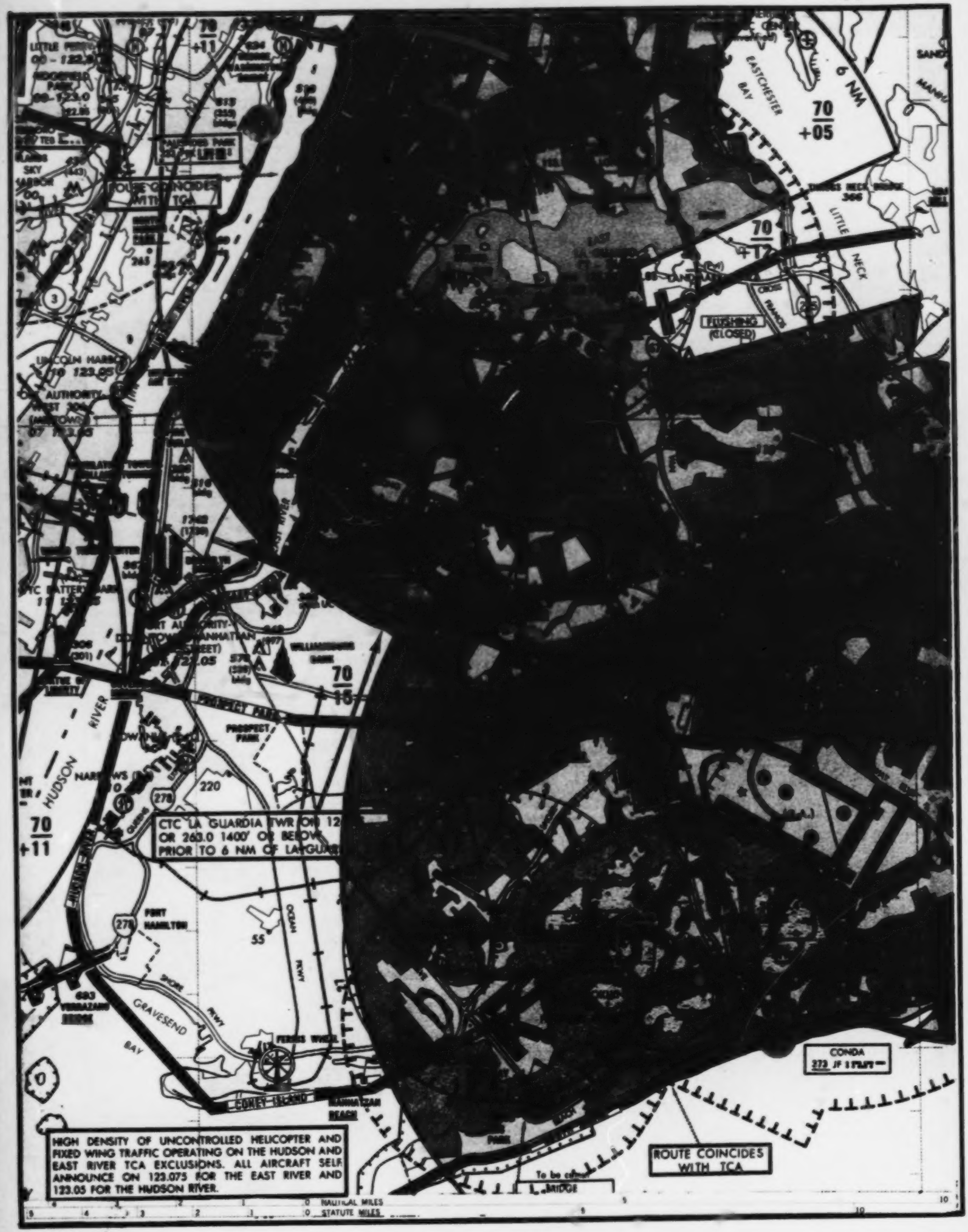
199


RNAV RWY 32
AL-65 (FAA)
BUFFALO/GREATER BUFFALO INTL (BUF)
BUFFALO, NEW YOR
BUFFALO APP CON
123.8 226.5
BUFFALO TOWER
120.5 257.8
GND CON
121.9 257.8
CLNC DEL
124.7 257.8
ASR
ATIS
135.35
GANIS
43°00.6'N 78°53.8'W
116.4 BUF 302.0°-12.1
730
1549
122
302°
1349
1054
832
855
MAP
42°56.3'N 78°43.6'W
116.4 BUF 286.9°-3.5
730
FAF
CYUGA
42°53.3'N 78°38.1'W
116.4 BUF 175.1°-2.5
730
315°
WALES
42°48.6'N 78°29.3'W
116.4 BUF 143.4°-10.0
730
2300
315° (8)
3500
301°
(8.7)
(IAF)
DALEE
2314
2699
MISSED APPROACH
Climb to 2700 direct Ganis WPT and hold.
MAP WPT
CYUGA WPT
WALES WPT
3500
315°
2300
2.91°
1.5 NM
3.5 NM
8 NM
ELEV 724
Rwy 5 ldg 7767'
769±
768
780
8102 X 150
5376 X 150
TDZE 714
32
779
TWR 803
714
694
315° to MAP WPT
REIL Rwy 32
TDZ/CL Rwys 5 and 23
MIRL Rwy 14-32
HIRL Rwy 5-23
RNAV RWY 32
42°56'N - 78°44'W
BUFFALO, NEW YORK
BUFFALO/GREATER BUFFALO INTL (BUF)

| CATEGORY | A | B | C | D |
|---|---|---|---|---|
| S-32 | 1220-1 506 (500-1) | | 1220-1½ 506 (500-1½) | |
| CIRCLING | 1220-1 496 (500-1) | | 1220-1½<br>496 (500-1½) | 1280-2<br>556 (600-2) |

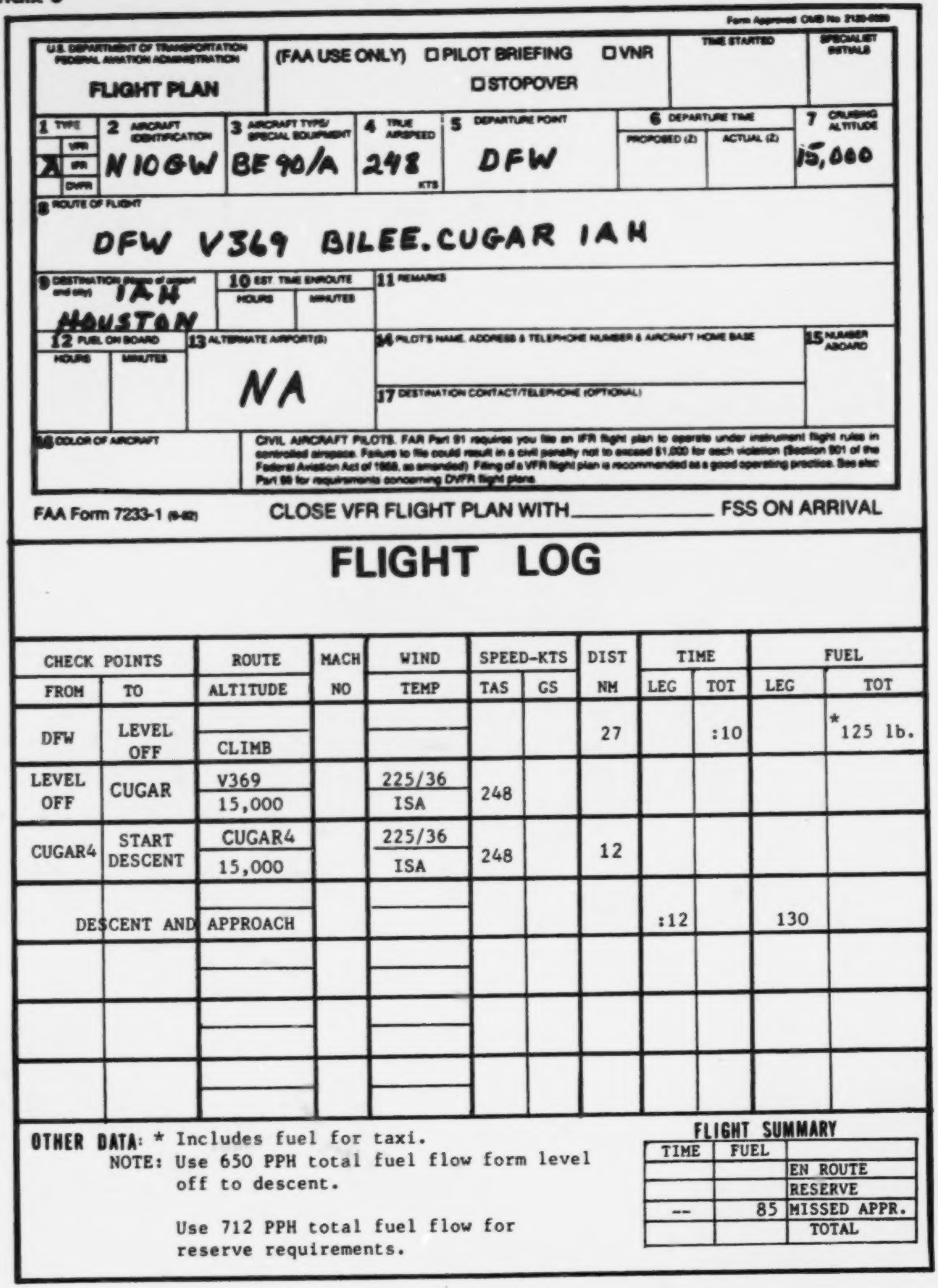
§ **GREATER BUFFALO INTL** (BUF) 5 E UTC-5(-4DT) 42°56'26"N 78°43'57"W **DETROIT**
724 B S4 **FUEL** 100LL, JET A OX 1, 2, 3, 4 LRA ARFF Index D **H-3C, 6I, L-12F**
**RWY 05-23:** H8102X150 (ASPH-GRVD) S-75, D-195, DT-450 HIRL CL 0.6% up NE **IAP**
**RWY 05:** SSALR. TDZ. Thld dsplcd 335'. Pole. **RWY 23:** SSALR. TDZ.
**RWY 14-32:** H5376X150 (ASPH) S-75, D-100, DT-160 MIRL 0.3% up SE.
**RWY 14:** VASI(V4L)—GA 3.0°TCH 55'. Tree. **RWY 32:** REIL. VASI(V4L)—GA 3.0°TCH 55'. Fence
**AIRPORT REMARKS:** Attended continuously. Landing fee. CAUTION-Jet engine test stand located approximately 3600' from approach end Rwy 32 1400' south center line . Jet exhaust may reach altitude 100' AGL. Ops conducted occasionally 1300-2300Z‡. CAUTION: Numerous types of birds may be encountered in holding pattern over Grand Island up to 5000'. Heavy concentration of Gulls, Blackbirds, and Starlings up to 5000' on and in vicinity of arpt. Deer on and in vicinity of arpt. Flight Notification Service (ADCUS) available.
**WEATHER DATA SOURCES:** LLWAS.
**COMMUNICATIONS:** ATIS 135.35 **UNICOM** 122.95
**BUFFALO FSS** (BUF) on arpt. 122.6 122.2 122.1R 116.4T DL NOTAM FILE BUF.
Ⓡ **BUFFALO APP DEP/CON** 123.8 (055°-194°) 126.5 (195°-279°) 126.15 (280°-054°)
**BUFFALO TOWER** 120.5 **GND CON** 121.9
**CLNC DEL** 124.7 **PRE-TAXI CLNC** 124.7
**ARSA** ctc **APP CON**
**RADIO AIDS TO NAVIGATION:** NOTAM FILE BUF.
**BUFFALO (H) VORTAC** 116.4 BUF Chan 111 42°55'44"N 78°38'48"W 288°3.5 NM to fld. 730/08W.
**KLUMP NDB (LOM)** 231 BU 43°00'01"N 78°39'04"W 233° 4.4 NM to fld. unusable beyond 12 NM.
**PLAZZ NDB (LOM)** 204 GB 42°52'26"N 78°49'00"W 053° 4.8 NM to fld.
**ILS** 111.3 I-BUF Rwy 23 LOM KLUMP NDB. Inner marker out of svc indefinitely. Back course unusable beyond 15 NM.
**ILS** 108.5 I-GBI Rwy 05 LOM PLAZZ NDB.
**ASR**

FIGURE 17.—RNAV RWY 32 and Excerpt (BUF).


EASTCHESTER BAY
6 NM
70
+05
LITTLE NECK
70
FLUSHING (CLOSED)
LINCOLN HARBOR
ROUTE COINCIDES WITH TCA
70
+11
PROSPECT PARK
70
15
HUDSON
RIVER
220
278
CTC LA GUARDIA TWR ON 12
OR 263.0 1400' OR BELOW
PRIOR TO 6 NM OF LA GUAR
FORT HAMILTON
OCEAN PKWY
55
SHORE PKWY
GRAVESEND
BAY
693
VERRAZANO BRIDGE
FERRIS WHEEL
CONEY ISLAND
MANHATTAN BEACH
CONDA
ROUTE COINCIDES WITH TCA
NAUTICAL MILES
STATUTE MILES

HIGH DENSITY OF UNCONTROLLED HELICOPTER AND FIXED WING TRAFFIC OPERATING ON THE HUDSON AND EAST RIVER TCA EXCLUSIONS. ALL AIRCRAFT SELF ANNOUNCE ON 123.075 FOR THE EAST RIVER AND 123.05 FOR THE HUDSON RIVER.

FIGURE 18.—Helicopter Route Chart.



Form Approved OMB No 2120-0026

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

**FLIGHT PLAN**

(FAA USE ONLY) ☐ PILOT BRIEFING ☐ VNR ☐ STOPOVER

TIME STARTED

SPECIALIST INITIALS

1 TYPE: ☐ VFR ☒ IFR ☐ DVFR

2 AIRCRAFT IDENTIFICATION: N10GW

3 AIRCRAFT TYPE/SPECIAL EQUIPMENT: BE 90/A

4 TRUE AIRSPEED: 248 KTS

5 DEPARTURE POINT: DFW

6 DEPARTURE TIME: PROPOSED (Z) ACTUAL (Z)

7 CRUISING ALTITUDE: 15,000

8 ROUTE OF FLIGHT: DFW V369 BILEE.CUGAR IAH

9 DESTINATION (Name of airport and city): IAH HOUSTON

10 EST. TIME ENROUTE: HOURS MINUTES

11 REMARKS

12 FUEL ON BOARD: HOURS MINUTES

13 ALTERNATE AIRPORT(S): NA

14 PILOT'S NAME, ADDRESS & TELEPHONE NUMBER & AIRCRAFT HOME BASE

15 NUMBER ABOARD

16 COLOR OF AIRCRAFT

17 DESTINATION CONTACT/TELEPHONE (OPTIONAL)

CIVIL AIRCRAFT PILOTS. FAR Part 91 requires you file an IFR flight plan to operate under instrument flight rules in controlled airspace. Failure to file could result in a civil penalty not to exceed $1,000 for each violation (Section 901 of the Federal Aviation Act of 1958, as amended). Filing of a VFR flight plan is recommended as a good operating practice. See also Part 99 for requirements concerning DVFR flight plans.

FAA Form 7233-1 (8-82)

CLOSE VFR FLIGHT PLAN WITH ____________ FSS ON ARRIVAL

**FLIGHT LOG**

| CHECK POINTS | | ROUTE | MACH | WIND | SPEED-KTS | | DIST | TIME | | FUEL | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM | TO | ALTITUDE | NO | TEMP | TAS | GS | NM | LEG | TOT | LEG | TOT |
| DFW | LEVEL OFF | CLIMB | | | | | 27 | | :10 | | *125 lb. |
| LEVEL OFF | CUGAR | V369<br>15,000 | | 225/36<br>ISA | 248 | | | | | | |
| CUGAR4 | START DESCENT | CUGAR4<br>15,000 | | 225/36<br>ISA | 248 | | 12 | | | | |
| DESCENT AND APPROACH | | | | | | | | :12 | | 130 | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

**OTHER DATA:** * Includes fuel for taxi.
NOTE: Use 650 PPH total fuel flow form level off to descent.

Use 712 PPH total fuel flow for reserve requirements.

**FLIGHT SUMMARY**

| TIME | FUEL | |
|---|---|---|
| | | EN ROUTE |
| | | RESERVE |
| -- | 85 | MISSED APPR. |
| | | TOTAL |

FIGURE 19.—Flight Plan/Flight Log.

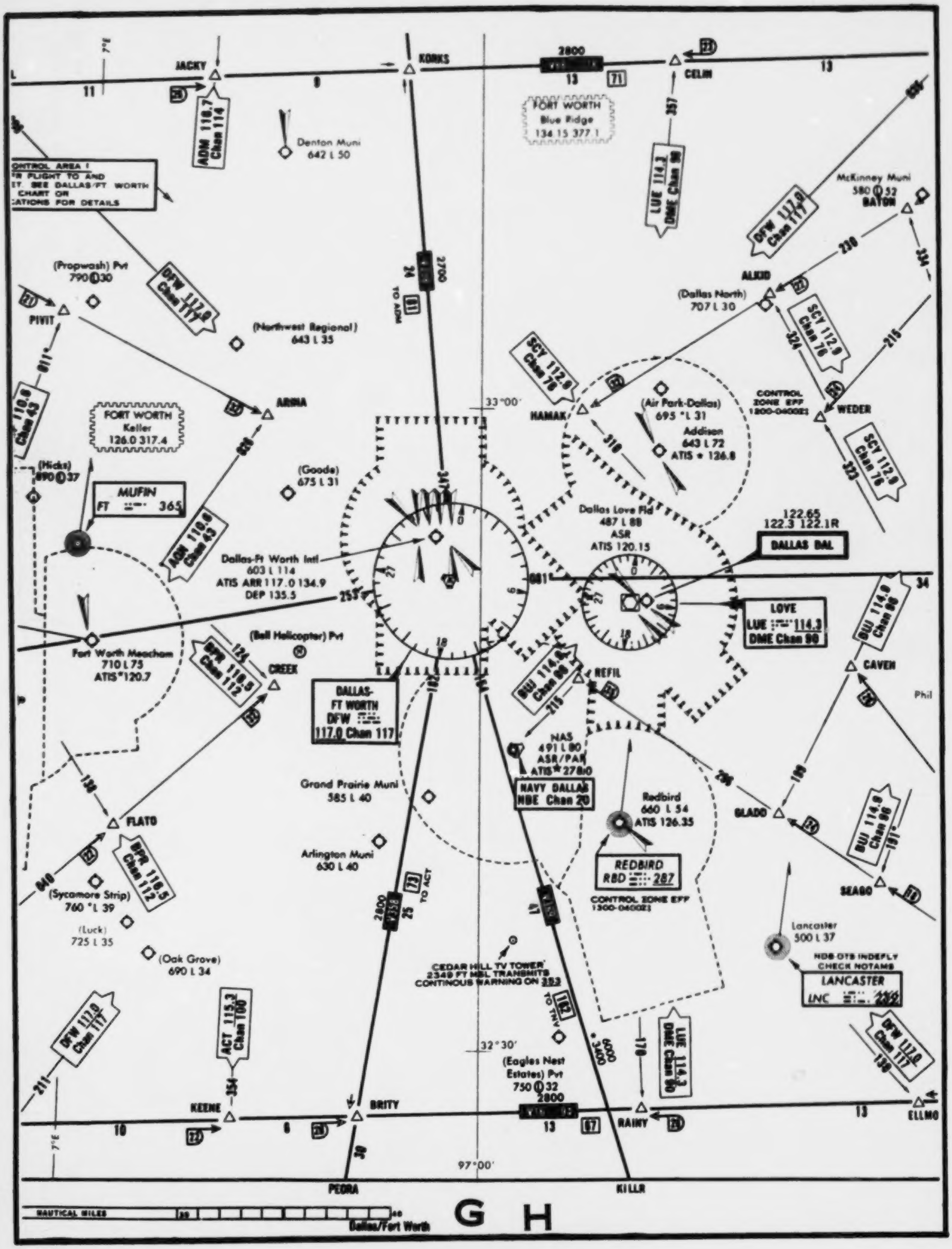

JACKY
KORKS
CELIN
2800
11
9
13
71
ADM 110.7 Chan 114
Denton Muni
642 L 50
FORT WORTH
Blue Ridge
134.15 377.1
LUE 114.3 DME Chan 90
357
CONTROL AREA
FLIGHT TO AND
SEE DALLAS/FT WORTH
CHART OR
ATIONS FOR DETAILS
McKinney Muni
580 Ⓡ 52
BATON
DFW 117.0 Chan 117
230
334
(Propwash) Pvt
790 Ⓡ 30
PIVIT
2700
34
TO ADM
ALKID
(Dallas North)
707 L 30
SCY 112.9 Chan 76
326
215
(Northwest Regional)
643 L 35
110
ADM 110.6 Chan 43
ARIHA
FORT WORTH
Keller
126.0 317.4
33°00'
HAMAK
(Air Park-Dallas)
695 *L 31
Addison
643 L 72
ATIS ★ 126.8
CONTROL ZONE EFF 1200-0400Z‡
WEDER
310
323
(Hicks)
690 Ⓡ 37
MUFIN
FT 365
028
(Goode)
675 L 31
347
Dallas Love Fld
487 L 89
ASR
ATIS 120.15
122.65
122.3 122.1R
DALLAS DAL
Dallas-Ft Worth Intl
603 L 114
ATIS ARR 117.0 134.9
DEP 135.5
253
081
LOVE
LUE 114.3
DME Chan 90
34
BUJ 114.9 Chan 96
Fort Worth Meacham
710 L 75
ATIS*120.7
(Bell Helicopter) Pvt
BPR 116.5 Chan 112
124
CREEK
CAVEN
Phil
DALLAS-FT WORTH
DFW
117.0 Chan 117
REFIL
215
NAS
491 L 80
ASR/PAR
ATIS★ 278.0
NAVY DALLAS
NBE Chan 20
206
199
155
Grand Prairie Muni
585 L 40
Redbird
660 L 54
ATIS 126.35
GLADO
FLATO
BPR 116.5 Chan 112
REDBIRD
RBD 287
CONTROL ZONE EFF 1300-0400Z‡
191
SEAGO
040
Arlington Muni
630 L 40
(Sycamore Strip)
760 *L 39
(Luck)
725 L 35
2800
V358
25
TO ACT
17
(Oak Grove)
690 L 34
Lancaster
500 L 37
NDB OTS INDEFLY
CHECK NOTAMS
LANCASTER
LNC 239
CEDAR HILL TV TOWER
2349 FT MSL TRANSMITS
CONTINOUS WARNING ON 393
TO ANL
DFW 117.0 Chan 117
ACT 115.3 Chan 100
211
32°30'
(Eagles Nest Estates) Pvt
750 Ⓡ 32
6000
*3400
178
LUE 114.3 DME Chan 90
136
2800
KEENE
354
BRITY
RAINY
ELLMO
10
6
13
13
67
30
97°00'
PEGRA
KILLR
NAUTICAL MILES
Dallas/Fort Worth
G
H
3°E
7°E

FIGURE 20.—IFR Area Chart Segment.

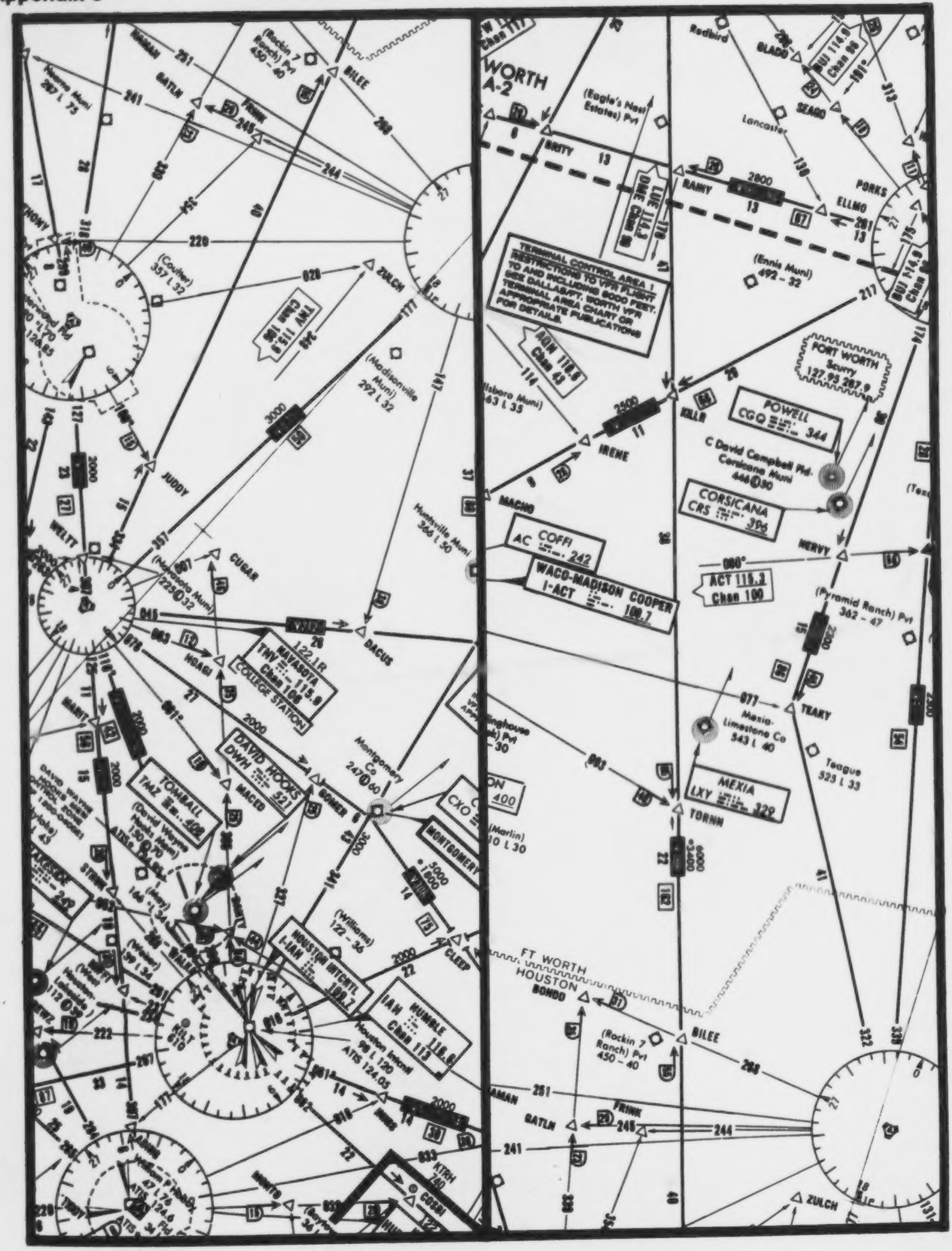
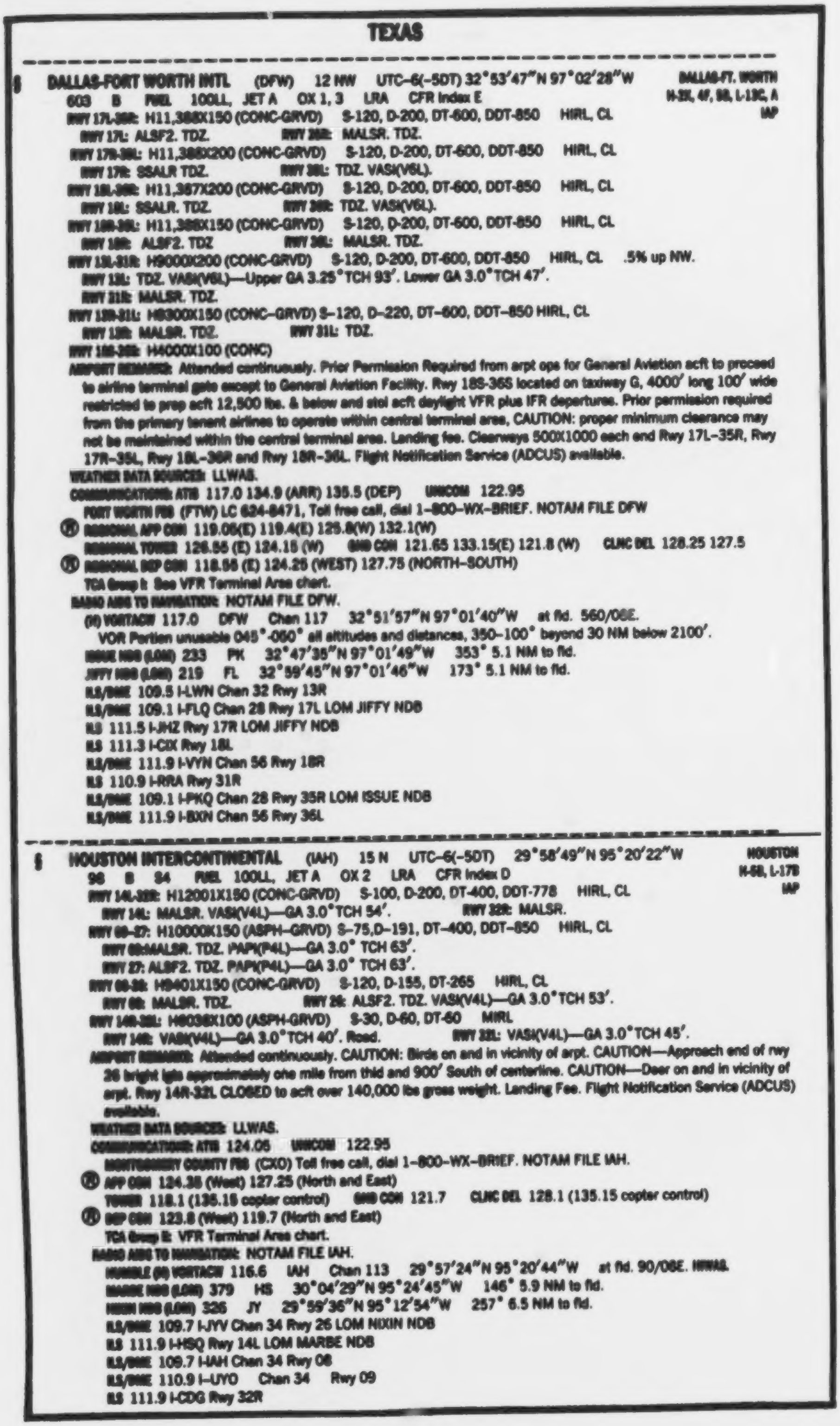

WORTH
A-2
TERMINAL CONTROL AREA I RESTRICTIONS TO VFR FLIGHT TO AND INCLUDING 6000 FEET. SEE DALLAS/FT. WORTH VFR TERMINAL AREA CHART OR APPROPRIATE PUBLICATIONS FOR DETAILS.
FORT WORTH
127.95 287.9
POWELL
CGO 344
CORSICANA
CRS 306
COFFI
AC 242
WACO-MADISON COOPER
I-ACT 109.7
ACT 115.3
Chan 100
MEXIA
LXY 329
TOMBALL
TMZ 406
DAVID HOOKS
DWH 321
HOUSTON INTCNTL
I-IAH 109.7
HUMBLE
IAH 116.6
Chan 113
NAVASOTA
TNV 115.9
Chan 106
COLLEGE STATION
FT WORTH
HOUSTON
BILEE
ZULCH
JUDDY
CUGAR
DACUS
HOAGI
MACED
SOMER
CLEEP
IRENE
MACHO
KELLR
TORNN
TEAKY
MERVY
RAMY
ELLMO
BRITY
SEAGO
BLADO
PORKS
BONDO
GATLN
FRINK
HAMAN

FIGURE 21.—IFR En Route Low Altitude Chart Segment.



## TEXAS

§ **DALLAS-FORT WORTH INTL** (DFW) 12 NW UTC-6(-5DT) 32°53′47″N 97°02′28″W **DALLAS-FT. WORTH**
603 B **FUEL** 100LL, JET A OX 1, 3 LRA CFR Index E **H-2K, 4F, 5B, L-13C, A**
**RWY 17L-35R:** H11,388X150 (CONC-GRVD) S-120, D-200, DT-600, DDT-850 HIRL, CL **IAP**
**RWY 17L:** ALSF2. TDZ. **RWY 35R:** MALSR. TDZ.
**RWY 17R-35L:** H11,388X200 (CONC-GRVD) S-120, D-200, DT-600, DDT-850 HIRL, CL
**RWY 17R:** SSALR TDZ. **RWY 35L:** TDZ. VASI(V6L).
**RWY 18L-36R:** H11,387X200 (CONC-GRVD) S-120, D-200, DT-600, DDT-850 HIRL, CL
**RWY 18L:** SSALR. TDZ. **RWY 36R:** TDZ. VASI(V6L).
**RWY 18R-36L:** H11,388X150 (CONC-GRVD) S-120, D-200, DT-600, DDT-850 HIRL, CL
**RWY 18R:** ALSF2. TDZ **RWY 36L:** MALSR. TDZ.
**RWY 13L-31R:** H9000X200 (CONC-GRVD) S-120, D-200, DT-600, DDT-850 HIRL, CL .5% up NW.
**RWY 13L:** TDZ. VASI(V6L)—Upper GA 3.25°TCH 93′. Lower GA 3.0°TCH 47′.
**RWY 31R:** MALSR. TDZ.
**RWY 13R-31L:** H9300X150 (CONC–GRVD) S–120, D–220, DT–600, DDT–850 HIRL, CL
**RWY 13R:** MALSR. TDZ. **RWY 31L:** TDZ.
**RWY 18S-36S:** H4000X100 (CONC)
**AIRPORT REMARKS:** Attended continuously. Prior Permission Required from arpt ops for General Aviation acft to proceed to airline terminal gate except to General Aviation Facility. Rwy 18S-36S located on taxiway G, 4000′ long 100′ wide restricted to prop acft 12,500 lbs. & below and stol acft daylight VFR plus IFR departures. Prior permission required from the primary tenent airlines to operate within central terminal area, CAUTION: proper minimum clearance may not be maintained within the central terminal area. Landing fee. Clearways 500X1000 each end Rwy 17L–35R, Rwy 17R–35L, Rwy 18L–36R and Rwy 18R–36L. Flight Notification Service (ADCUS) available.
**WEATHER DATA SOURCES:** LLWAS.
**COMMUNICATIONS: ATIS** 117.0 134.9 (ARR) 135.5 (DEP) **UNICOM** 122.95
**FORT WORTH FSS** (FTW) LC 624-8471, Toll free call, dial 1–800–WX–BRIEF. NOTAM FILE DFW
Ⓡ **REGIONAL APP CON** 119.05(E) 119.4(E) 125.8(W) 132.1(W)
**REGIONAL TOWER** 126.55 (E) 124.15 (W) **GND CON** 121.65 133.15(E) 121.8 (W) **CLNC DEL** 128.25 127.5
Ⓡ **REGIONAL DEP CON** 118.55 (E) 124.25 (WEST) 127.75 (NORTH–SOUTH)
**TCA Group I:** See VFR Terminal Area chart.
**RADIO AIDS TO NAVIGATION:** NOTAM FILE DFW.
**(H) VORTACW** 117.0 DFW Chan 117 32°51′57″N 97°01′40″W at fld. 560/08E.
VOR Portion unusable 045°-050° all altitudes and distances, 350–100° beyond 30 NM below 2100′.
**ISSUE NDB (LOM)** 233 PK 32°47′35″N 97°01′49″W 353° 5.1 NM to fld.
**JIFFY NDB (LOM)** 219 FL 32°59′45″N 97°01′46″W 173° 5.1 NM to fld.
**ILS/DME** 109.5 I-LWN Chan 32 Rwy 13R
**ILS/DME** 109.1 I-FLQ Chan 28 Rwy 17L LOM JIFFY NDB
**ILS** 111.5 I-JHZ Rwy 17R LOM JIFFY NDB
**ILS** 111.3 I-CIX Rwy 18L
**ILS/DME** 111.9 I-VYN Chan 56 Rwy 18R
**ILS** 110.9 I-RRA Rwy 31R
**ILS/DME** 109.1 I-PKQ Chan 28 Rwy 35R LOM ISSUE NDB
**ILS/DME** 111.9 I-BXN Chan 56 Rwy 36L

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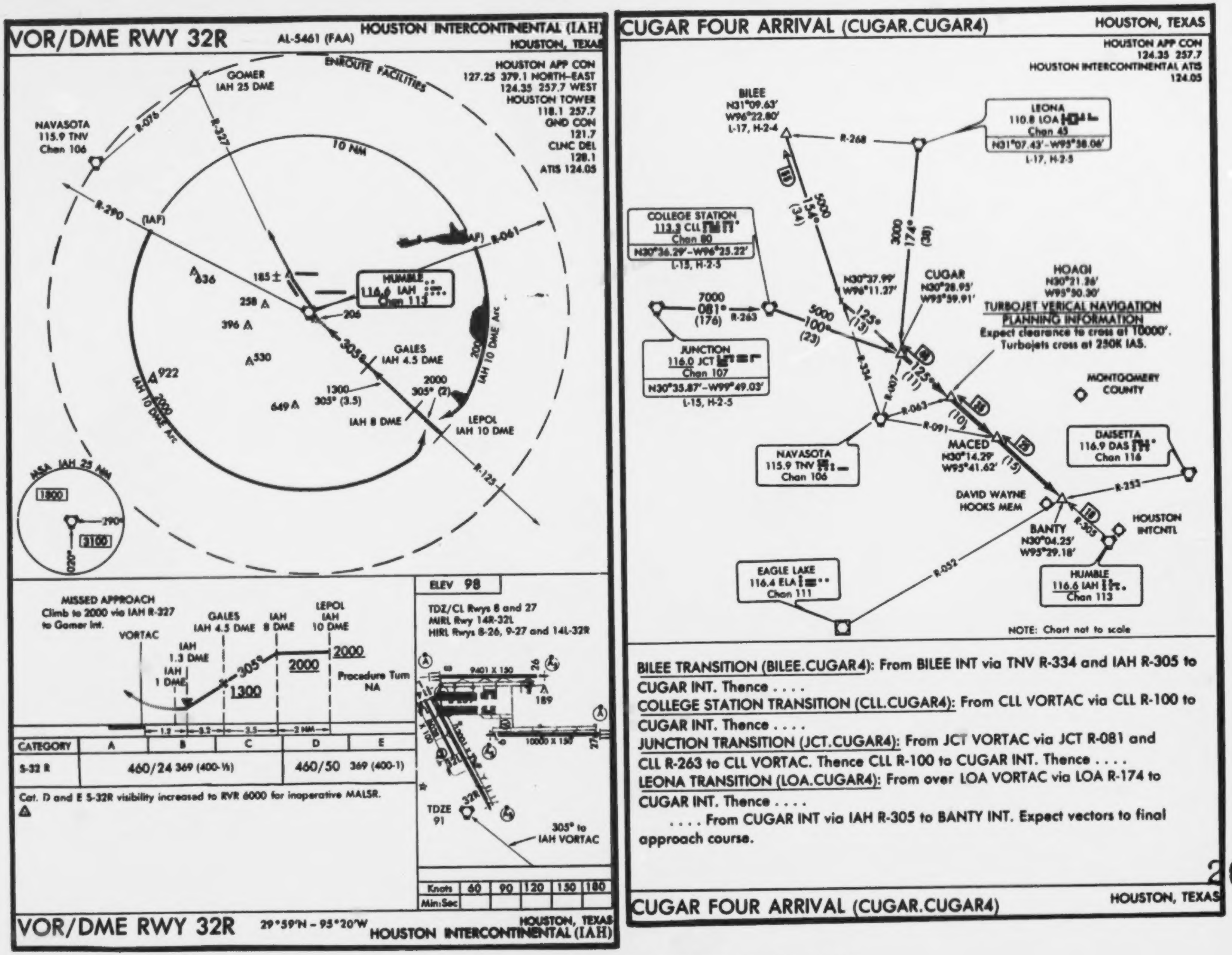
§ **HOUSTON INTERCONTINENTAL** (IAH) 15 N UTC-6(-5DT) 29°58′49″N 95°20′22″W **HOUSTON**
98 B S4 **FUEL** 100LL, JET A OX 2 LRA CFR Index D **H-5B, L-17B**
**RWY 14L-32R:** H12001X150 (CONC-GRVD) S-100, D-200, DT-400, DDT-778 HIRL, CL **IAP**
**RWY 14L:** MALSR. VASI(V4L)—GA 3.0°TCH 54′. **RWY 32R:** MALSR.
**RWY 09–27:** H10000X150 (ASPH–GRVD) S–75,D–191, DT–400, DDT–850 HIRL, CL
**RWY 09:**MALSR. TDZ. PAPI(P4L)—GA 3.0° TCH 63′.
**RWY 27:** ALSF2. TDZ. PAPI(P4L)—GA 3.0° TCH 63′.
**RWY 08-26:** H9401X150 (CONC-GRVD) S-120, D-155, DT-265 HIRL, CL
**RWY 08:** MALSR. TDZ. **RWY 26:** ALSF2. TDZ. VASI(V4L)—GA 3.0°TCH 53′.
**RWY 14R-32L:** H6038X100 (ASPH-GRVD) S-30, D-60, DT-60 MIRL
**RWY 14R:** VASI(V4L)—GA 3.0°TCH 40′. Road. **RWY 32L:** VASI(V4L)—GA 3.0°TCH 45′.
**AIRPORT REMARKS:** Attended continuously. CAUTION: Birds on and in vicinity of arpt. CAUTION—Approach end of rwy 26 bright lgts approximately one mile from thld and 900′ South of centerline. CAUTION—Deer on and in vicinity of arpt. Rwy 14R-32L CLOSED to acft over 140,000 lbs gross weight. Landing Fee. Flight Notification Service (ADCUS) available.
**WEATHER DATA SOURCES:** LLWAS.
**COMMUNICATIONS: ATIS** 124.05 **UNICOM** 122.95
**MONTGOMERY COUNTY FSS** (CXO) Toll free call, dial 1–800–WX–BRIEF. NOTAM FILE IAH.
Ⓡ **APP CON** 124.35 (West) 127.25 (North and East)
**TOWER** 118.1 (135.15 copter control) **GND CON** 121.7 **CLNC DEL** 128.1 (135.15 copter control)
Ⓡ **DEP CON** 123.8 (West) 119.7 (North and East)
**TCA Group II:** VFR Terminal Area chart.
**RADIO AIDS TO NAVIGATION:** NOTAM FILE IAH.
**HUMBLE (H) VORTACW** 116.6 IAH Chan 113 29°57′24″N 95°20′44″W at fld. 90/08E. **HIWAS.**
**MARBE NDB (LOM)** 379 HS 30°04′29″N 95°24′45″W 146° 5.9 NM to fld.
**NIXIN NDB (LOM)** 326 JY 29°59′36″N 95°12′54″W 257° 6.5 NM to fld.
**ILS/DME** 109.7 I-JYV Chan 34 Rwy 26 LOM NIXIN NDB
**ILS** 111.9 I-HSQ Rwy 14L LOM MARBE NDB
**ILS/DME** 109.7 I-IAH Chan 34 Rwy 08
**ILS/DME** 110.9 I–UYO Chan 34 Rwy 09
**ILS** 111.9 I-CDG Rwy 32R

FIGURE 22.—Airport/Facility Directory Excerpts.


VOR/DME RWY 32R
AL-5461 (FAA)
HOUSTON INTERCONTINENTAL (IAH)
HOUSTON, TEXAS
HOUSTON APP CON
127.25 379.1 NORTH-EAST
124.35 257.7 WEST
HOUSTON TOWER
118.1 257.7
GND CON
121.7
CLNC DEL
128.1
ATIS 124.05
ENROUTE FACILITIES
GOMER
IAH 25 DME
NAVASOTA
115.9 TNV
Chan 106
R-076
R-327
10 NM
R-290
(IAF)
(IAF)
R-061
HUMBLE
116.6 IAH
Chan 113
636
185
258
396
530
922
649
206
305°
GALES
IAH 4.5 DME
1300
305° (3.5)
2000
305° (2)
IAH 8 DME
LEPOL
IAH 10 DME
IAH 10 DME Arc
2000
R-125
MSA IAH 25 NM
1800
3100
290°
020°
MISSED APPROACH
Climb to 2000 via IAH R-327 to Gomer Int.
VORTAC
IAH 1.3 DME
IAH 1 DME
GALES IAH 4.5 DME
IAH 8 DME
LEPOL IAH 10 DME
305°
1300
2000
2000
Procedure Turn NA
1.3
3.2
3.5
2 NM
ELEV 98
TDZ/CL Rwys 8 and 27
MIRL Rwy 14R-32L
HIRL Rwys 8-26, 9-27 and 14L-32R
9401 X 150
26
189
10000 X 150
27
TDZE 91
32R
305° to IAH VORTAC
Knots 60 90 120 150 180
Min:Sec
VOR/DME RWY 32R
29°59'N - 95°20'W
HOUSTON, TEXAS
HOUSTON INTERCONTINENTAL (IAH)
CUGAR FOUR ARRIVAL (CUGAR.CUGAR4)
HOUSTON, TEXAS
HOUSTON APP CON
124.35 257.7
HOUSTON INTERCONTINENTAL ATIS
124.05
BILEE
N31°09.63'
W96°22.80'
L-17, H-2-4
R-268
LEONA
110.8 LOA
Chan 45
N31°07.43'-W95°58.06'
L-17, H-2-5
5000
154°
(34)
3000
174°
(38)
COLLEGE STATION
113.3 CLL
Chan 80
N30°36.29'-W96°25.22'
L-15, H-2-5
N30°37.99'
W96°11.27'
CUGAR
N30°28.95'
W95°59.91'
HOAGI
N30°21.36'
W95°50.30'
TURBOJET VERICAL NAVIGATION PLANNING INFORMATION
Expect clearance to cross at 10000'.
Turbojets cross at 250K IAS.
7000
081°
(176)
R-263
5000
100°
(23)
125°
(13)
R-334
JUNCTION
116.0 JCT
Chan 107
N30°35.87'-W99°49.03'
L-15, H-2-5
R-063
R-107
125°
(11)
(10)
MONTGOMERY COUNTY
R-091
NAVASOTA
115.9 TNV
Chan 106
MACED
N30°14.29'
W95°41.62'
(15)
DAISETTA
116.9 DAS
Chan 116
R-253
DAVID WAYNE HOOKS MEM
BANTY
N30°04.25'
W95°29.18'
R-305
HOUSTON INTCNTL
EAGLE LAKE
116.4 ELA
Chan 111
R-052
HUMBLE
116.6 IAH
Chan 113
NOTE: Chart not to scale
CUGAR FOUR ARRIVAL (CUGAR.CUGAR4)
HOUSTON, TEXAS

| CATEGORY | A | B | C | D | E |
|---|---|---|---|---|---|
| S-32 R | 460/24 369 (400-½) | | | 460/50 369 (400-1) | |

Cat. D and E S-32R visibility increased to RVR 6000 for inoperative MALSR.

BILEE TRANSITION (BILEE.CUGAR4): From BILEE INT via TNV R-334 and IAH R-305 to CUGAR INT. Thence . . . .

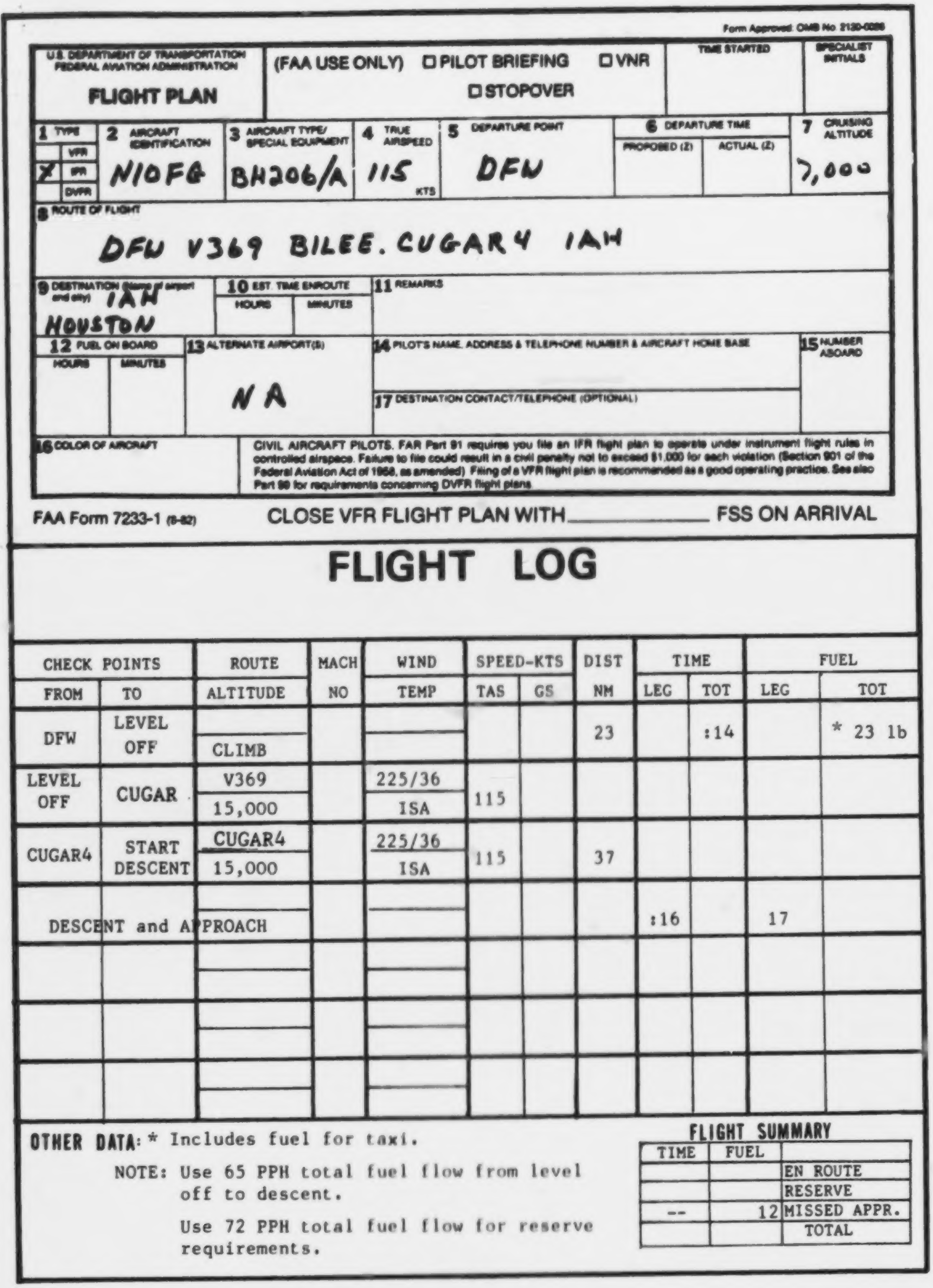
COLLEGE STATION TRANSITION (CLL.CUGAR4): From CLL VORTAC via CLL R-100 to CUGAR INT. Thence . . . .

JUNCTION TRANSITION (JCT.CUGAR4): From JCT VORTAC via JCT R-081 and CLL R-263 to CLL VORTAC. Thence CLL R-100 to CUGAR INT. Thence . . . .

LEONA TRANSITION (LOA.CUGAR4): From over LOA VORTAC via LOA R-174 to CUGAR INT. Thence . . . .

. . . . From CUGAR INT via IAH R-305 to BANTY INT. Expect vectors to final approach course.

FIGURE 23.—Cugar Four Arrival (Cugar.Cugar4)/VOR/DME RWY 32R (IAH).



Form Approved: OMB No 2120-0026

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

**FLIGHT PLAN**

(FAA USE ONLY) ☐ PILOT BRIEFING ☐ VNR ☐ STOPOVER

TIME STARTED

SPECIALIST INITIALS

1 TYPE: ☐ VFR ☒ IFR ☐ DVFR

2 AIRCRAFT IDENTIFICATION: N10FG

3 AIRCRAFT TYPE/ SPECIAL EQUIPMENT: BH206/A

4 TRUE AIRSPEED: 115 KTS

5 DEPARTURE POINT: DFW

6 DEPARTURE TIME: PROPOSED (Z) ACTUAL (Z)

7 CRUISING ALTITUDE: 7,000

8 ROUTE OF FLIGHT: DFW V369 BILEE. CUGAR4 IAH

9 DESTINATION (Name of airport and city): IAH HOUSTON

10 EST. TIME ENROUTE: HOURS MINUTES

11 REMARKS

12 FUEL ON BOARD: HOURS MINUTES

13 ALTERNATE AIRPORT(S): NA

14 PILOT'S NAME, ADDRESS & TELEPHONE NUMBER & AIRCRAFT HOME BASE

15 NUMBER ABOARD

16 COLOR OF AIRCRAFT

17 DESTINATION CONTACT/TELEPHONE (OPTIONAL)

CIVIL AIRCRAFT PILOTS. FAR Part 91 requires you file an IFR flight plan to operate under instrument flight rules in controlled airspace. Failure to file could result in a civil penalty not to exceed $1,000 for each violation (Section 901 of the Federal Aviation Act of 1958, as amended). Filing of a VFR flight plan is recommended as a good operating practice. See also Part 99 for requirements concerning DVFR flight plans.

FAA Form 7233-1 (8-82)    CLOSE VFR FLIGHT PLAN WITH ________ FSS ON ARRIVAL

## FLIGHT LOG

| CHECK POINTS | | ROUTE | MACH | WIND | SPEED-KTS | | DIST | TIME | | FUEL | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM | TO | ALTITUDE | NO | TEMP | TAS | GS | NM | LEG | TOT | LEG | TOT |
| DFW | LEVEL OFF | CLIMB | | | | | 23 | | :14 | | * 23 lb |
| LEVEL OFF | CUGAR | V369<br>15,000 | | 225/36<br>ISA | 115 | | | | | | |
| CUGAR4 | START DESCENT | CUGAR4<br>15,000 | | 225/36<br>ISA | 115 | | 37 | | | | |
| DESCENT and APPROACH | | | | | | | | :16 | | 17 | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

**OTHER DATA:** * Includes fuel for taxi.

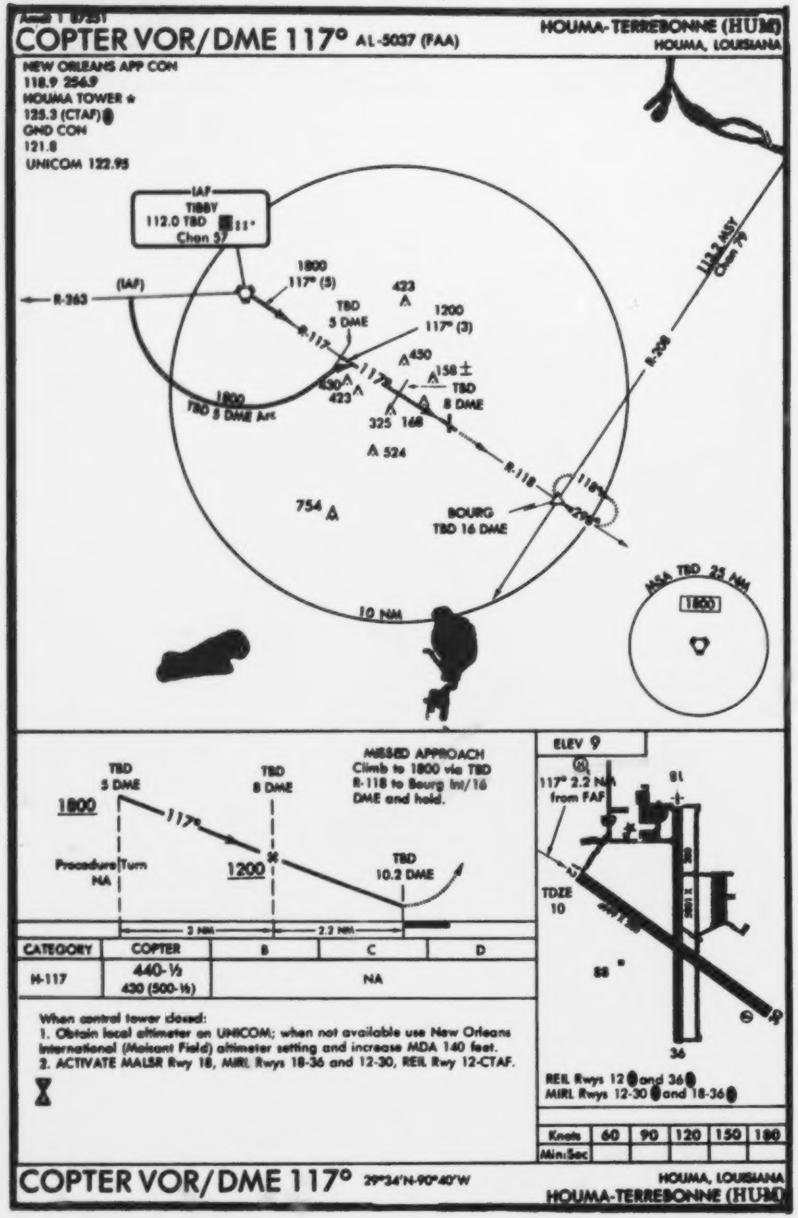
NOTE: Use 65 PPH total fuel flow from level off to descent.

Use 72 PPH total fuel flow for reserve requirements.

**FLIGHT SUMMARY**

| TIME | FUEL | |
|---|---|---|
| | | EN ROUTE |
| | | RESERVE |
| -- | 12 | MISSED APPR. |
| | | TOTAL |

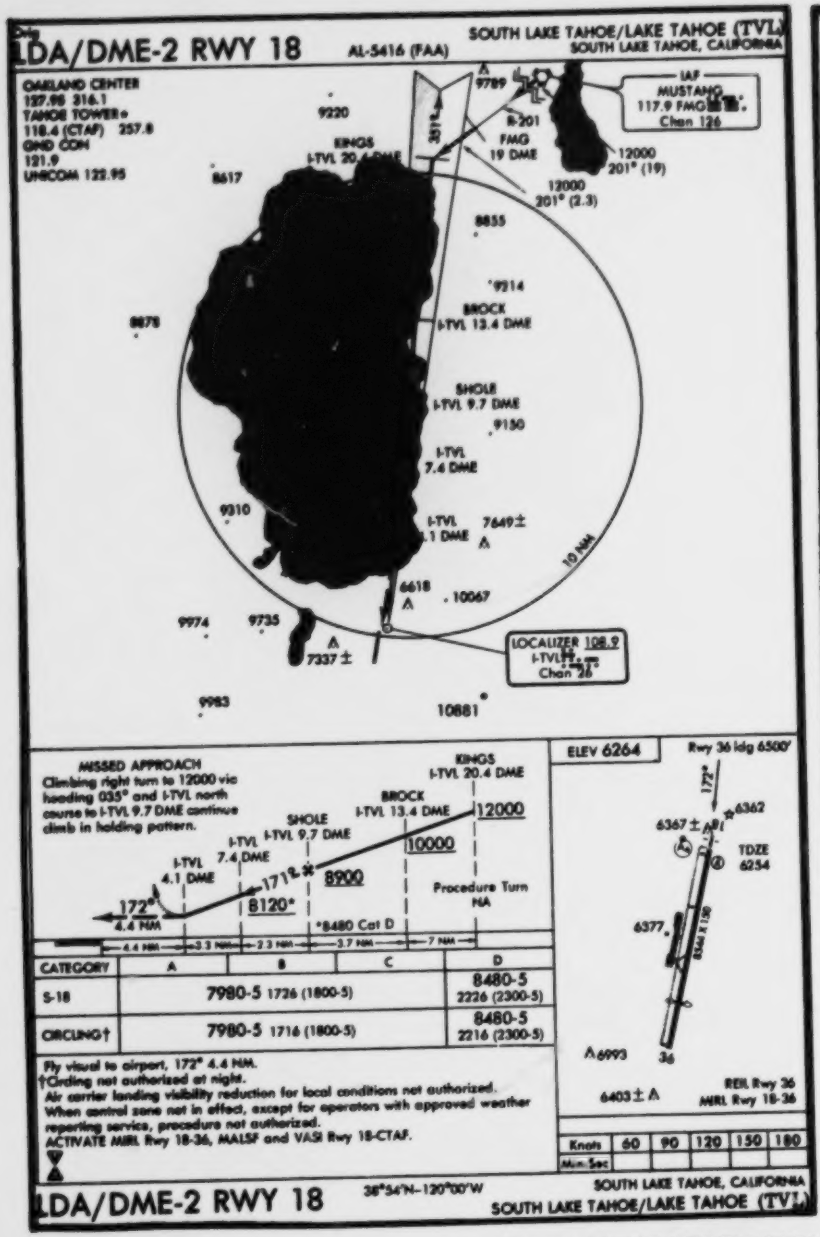
FIGURE 24.—Flight Plan/Flight Log.


Amdt 1 87251
COPTER VOR/DME 117° AL-5037 (FAA)
HOUMA-TERREBONNE (HUM)
HOUMA, LOUISIANA
NEW ORLEANS APP CON
118.9 256.9
HOUMA TOWER ★
125.3 (CTAF)
GND CON
121.8
UNICOM 122.95
IAF
TIBBY
112.0 TBD
Chan 57
(IAF)
R-263
1800
117° (5)
423
TBD
5 DME
1200
117° (3)
R-117
117°
450
158 ±
430
423
TBD
8 DME
1800
TBD 5 DME Arc
325
168
524
113.2 MSY
Chan 79
R-208
R-118
118°
298°
754
BOURG
TBD 16 DME
10 NM
MSA TBD 25 NM
1800
MISSED APPROACH
Climb to 1800 via TBD R-118 to Bourg Int/16 DME and hold.
TBD
5 DME
1800
117°
TBD
8 DME
Procedure Turn
NA
1200
TBD
10.2 DME
3 NM
2.2 NM
CATEGORY
COPTER
B
C
D
H-117
440-½
430 (500-½)
NA
When control tower closed:
1. Obtain local altimeter on UNICOM; when not available use New Orleans International (Moisant Field) altimeter setting and increase MDA 140 feet.
2. ACTIVATE MALSR Rwy 18, MIRL Rwys 18-36 and 12-30, REIL Rwy 12-CTAF.
ELEV 9
117° 2.2 NM
from FAF
18
TDZE
10
58
36
REIL Rwys 12 and 36
MIRL Rwys 12-30 and 18-36
Knots
60
90
120
150
180
Min:Sec
COPTER VOR/DME 117° 29°34'N-90°40'W
HOUMA, LOUISIANA
HOUMA-TERREBONNE (HUM)

## LOUISIANA

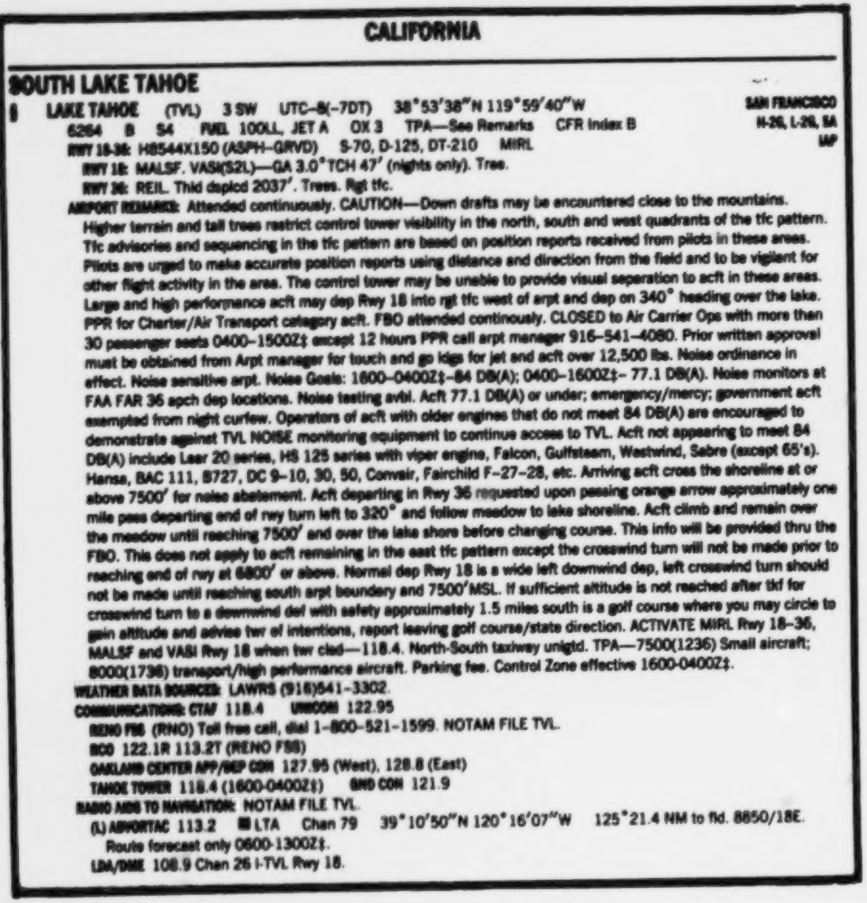
§ **HOUMA-TERREBONNE** (HUM) 3 SE UTC–6(–5DT) 29°34′03″N 90°39′37″W **NEW ORLEANS**
9 B S4 **FUEL** 100, 100LL, JET A OX 1, 4 TPA—(See Remarks) **H-5C, L-17D**
**RWY 18-36:** H5001X200 (CONC) S-50, D-70, DT-137 MIRL **IAP**
**RWY 18:** MALSR. VASI(NSTD)—GA 3.0°TCH 52′. Tree.
**RWY 36:** REIL. VASI(NSTD)—GA 3.0°TCH 39′.
**RWY 12-30:** H4999X200 (CONC) S-50, D-70, DT-137 MIRL
**RWY 12:** REIL. VASI(NSTD)—GA 3.0°TCH 34′. Road.
**RWY 30:** VASI(V2L)—GA 3.0°TCH 39′.
**AIRPORT REMARKS:** Attended dawn-dusk. CAUTION: Birds on and in vicinity of arpt. Oxygen avbl by prior request 504-876-0584. ACTIVATE MIRL Rwy 12–30 and Rwy 18–36 and MALSR Rwy 18 and REIL Rwy 12 and Rwy 36—CTAF. TPA—1009′(1000′), turbine powered 1509′(1500′). Control Zone effective 1200-0300Z‡ Mon-Fri, 1400-2400Z‡ Sat and Sun.
**WEATHER DATA SOURCES:** LAWRS (504) 879-4309.
**COMMUNICATIONS: CTAF** 125.3 **ATIS** 120.25 **UNICOM** 122.95
**DE RIDDER FSS** (DRI) Toll free call, dial 1–800–WX–BRIEF. NOTAM FILE HUM.
**TIBBY RCO** 122.1R 112.0T (DE RIDDER FSS)
Ⓡ **NEW ORLEANS APP/DEP CON** 118.9
**TOWER** 125.3 118.35 (1200-0300Z‡ Mon-Fri, 1400-2400Z‡ Sat-Sun) **GND CON** 121.8
**RADIO AIDS TO NAVIGATION:** NOTAM FILE DRI.
**TIBBY (L) VORTAC** 112.0 TBD Chan 57 29°39′51″N 90°49′44″W 117°10.2 NM to fld. 10/06E
**NDB (LOM)** 219 HU 29°39′47″N 90°39′34″W 176°5.3 NM to fld. NOTAM FILE HUM.
**ILS** 108.5 I-HUM RWY 18 LOM HOUMA NDB.

FIGURE 25.—Copter VOR/DME 117° (HUM) and Excerpt from A/FD.


Orig
LDA/DME-2 RWY 18
AL-5416 (FAA)
SOUTH LAKE TAHOE/LAKE TAHOE (TVL)
SOUTH LAKE TAHOE, CALIFORNIA
OAKLAND CENTER
127.95 316.1
TAHOE TOWER
118.4 (CTAF) 257.8
GND CON
121.9
UNICOM 122.95
9220
8617
9789
KINGS
I-TVL 20.4 DME
351°
R-201
FMG
19 DME
IAF
MUSTANG
117.9 FMG
Chan 126
12000
201° (19)
12000
201° (2.3)
8835
9214
BROCK
I-TVL 13.4 DME
8878
SHOLE
I-TVL 9.7 DME
9150
I-TVL
7.4 DME
9310
I-TVL
4.1 DME
7649±
10 NM
6618
10067
9974
9735
7337±
LOCALIZER 108.9
I-TVL
Chan 26
9983
10881
MISSED APPROACH
Climbing right turn to 12000 via heading 035° and I-TVL north course to I-TVL 9.7 DME continue climb in holding pattern.
KINGS
I-TVL 20.4 DME
BROCK
I-TVL 13.4 DME
12000
SHOLE
I-TVL 9.7 DME
10000
I-TVL
7.4 DME
I-TVL
4.1 DME
171°
8900
Procedure Turn
NA
172°
4.4 NM
8120*
*8480 Cat D
4.4 NM
3.3 NM
2.3 NM
3.7 NM
7 NM
ELEV 6264
Rwy 36 ldg 6500'
172°
6362
6367±
TDZE
6254
6377
8544 X 150
6993
36
6403±
REIL Rwy 36
MIRL Rwy 18-36
Knots
60
90
120
150
180
Min:Sec
LDA/DME-2 RWY 18
38°54'N-120°00'W
SOUTH LAKE TAHOE, CALIFORNIA
SOUTH LAKE TAHOE/LAKE TAHOE (TVL)

| CATEGORY | A | B | C | D |
|---|---|---|---|---|
| S-18 | 7980-5 1726 (1800-5) | | | 8480-5<br>2226 (2300-5) |
| CIRCLING† | 7980-5 1716 (1800-5) | | | 8480-5<br>2216 (2300-5) |

Fly visual to airport, 172° 4.4 NM.
†Circling not authorized at night.
Air carrier landing visibility reduction for local conditions not authorized.
When control zone not in effect, except for operators with approved weather reporting service, procedure not authorized.
ACTIVATE MIRL Rwy 18-36, MALSF and VASI Rwy 18-CTAF.



## CALIFORNIA

### SOUTH LAKE TAHOE

**LAKE TAHOE** (TVL) 3 SW UTC–8(–7DT) 38°53'38"N 119°59'40"W
SAN FRANCISCO
H-2B, L-2B, 5A
IAP

6264 B S4 **FUEL** 100LL, JET A OX 3 TPA—See Remarks CFR Index B

**RWY 18-36:** H8544X150 (ASPH–GRVD) S-70, D-125, DT-210 MIRL

**RWY 18:** MALSF. VASI(S2L)—GA 3.0°TCH 47' (nights only). Tree.

**RWY 36:** REIL. Thld dsplcd 2037'. Trees. Rgt tfc.

**AIRPORT REMARKS:** Attended continuously. CAUTION—Down drafts may be encountered close to the mountains. Higher terrain and tall trees restrict control tower visibility in the north, south and west quadrants of the tfc pattern. Tfc advisories and sequencing in the tfc pattern are based on position reports received from pilots in these areas. Pilots are urged to make accurate position reports using distance and direction from the field and to be vigilant for other flight activity in the area. The control tower may be unable to provide visual separation to acft in these areas. Large and high performance acft may dep Rwy 18 into rgt tfc west of arpt and dep on 340° heading over the lake. PPR for Charter/Air Transport category acft. FBO attended continously. CLOSED to Air Carrier Ops with more than 30 passenger seats 0400–1500Z‡ except 12 hours PPR call arpt manager 916–541–4080. Prior written approval must be obtained from Arpt manager for touch and go ldgs for jet and acft over 12,500 lbs. Noise ordinance in effect. Noise sensitive arpt. Noise Goals: 1600–0400Z‡–84 DB(A); 0400–1600Z‡– 77.1 DB(A). Noise monitors at FAA FAR 36 apch dep locations. Noise testing avbl. Acft 77.1 DB(A) or under; emergency/mercy; government acft exempted from night curfew. Operators of acft with older engines that do not meet 84 DB(A) are encouraged to demonstrate against TVL NOISE monitoring equipment to continue access to TVL. Acft not appearing to meet 84 DB(A) include Lear 20 series, HS 125 series with viper engine, Falcon, Gulfstream, Westwind, Sabre (except 65's). Hansa, BAC 111, B727, DC 9–10, 30, 50, Convair, Fairchild F–27–28, etc. Arriving acft cross the shoreline at or above 7500' for noise abatement. Acft departing in Rwy 36 requested upon passing orange arrow approximately one mile pass departing end of rwy turn left to 320° and follow meadow to lake shoreline. Acft climb and remain over the meadow until reaching 7500' and over the lake shore before changing course. This info will be provided thru the FBO. This does not apply to acft remaining in the east tfc pattern except the crosswind turn will not be made prior to reaching end of rwy at 6800' or above. Normal dep Rwy 18 is a wide left downwind dep, left crosswind turn should not be made until reaching south arpt boundary and 7500'MSL. If sufficient altitude is not reached after tkf for crosswind turn to a downwind dep with safety approximately 1.5 miles south is a golf course where you may circle to gain altitude and advise twr of intentions, report leaving golf course/state direction. ACTIVATE MIRL Rwy 18–36, MALSF and VASI Rwy 18 when twr clsd—118.4. North-South taxiway unlgtd. TPA—7500(1236) Small aircraft; 8000(1736) transport/high performance aircraft. Parking fee. Control Zone effective 1600-0400Z‡.

**WEATHER DATA SOURCES:** LAWRS (916)541–3302.

**COMMUNICATIONS:** CTAF 118.4 **UNICOM** 122.95

**RENO FSS** (RNO) Toll free call, dial 1–800–521–1599. NOTAM FILE TVL.

**RCO** 122.1R 113.2T (RENO FSS)

**OAKLAND CENTER APP/DEP CON** 127.95 (West), 128.8 (East)

**TAHOE TOWER** 118.4 (1600-0400Z‡) **GND CON** 121.9

**RADIO AIDS TO NAVIGATION:** NOTAM FILE TVL.

(L) **ABVORTAC** 113.2 ■ LTA Chan 79 39°10'50"N 120°16'07"W 125°21.4 NM to fld. 8850/18E.
Route forecast only 0600-1300Z‡.

**LDA/DME** 108.9 Chan 26 I-TVL Rwy 18.

FIGURE 26.—LDA/DME-2 RWY 18 (TVL) and Excerpt from A/FD.

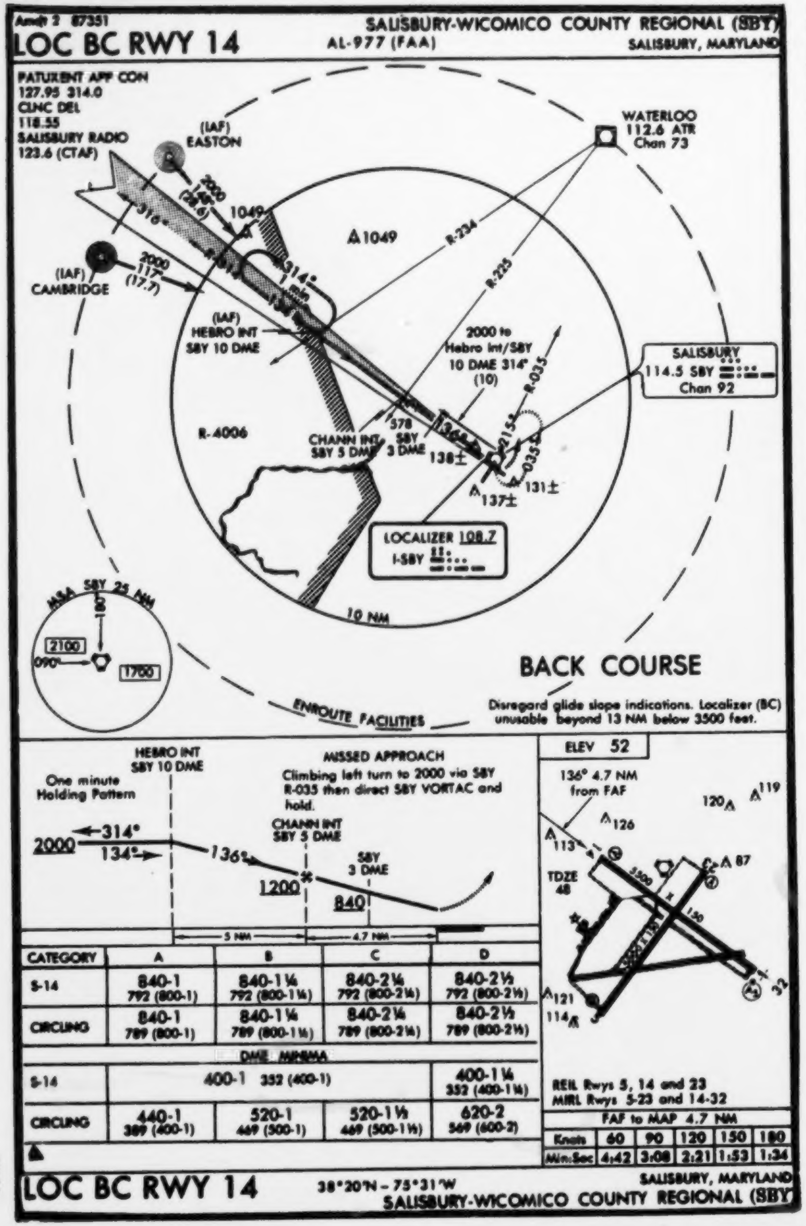
Amdt 2 87351

LOC BC RWY 14

AL-977 (FAA)

SALISBURY-WICOMICO COUNTY REGIONAL (SBY)

SALISBURY, MARYLAND


PATUXENT APP CON
127.95 314.0
CLNC DEL
118.55
SALISBURY RADIO
123.6 (CTAF)
(IAF)
EASTON
2000
155°
(28.6)
1049
316°
(IAF)
CAMBRIDGE
2000
117°
(17.7)
314°
1 min
134°
A1049
R-234
R-225
WATERLOO
112.6 ATR
Chan 73
(IAF)
HEBRO INT
SBY 10 DME
2000 to
Hebro Int/SBY
10 DME 314°
(10)
R-035
SALISBURY
114.5 SBY
Chan 92
R-4006
CHANN INT
SBY 5 DME
578
SBY
3 DME
136°
215°
035°
138±
131±
137±
LOCALIZER 108.7
I-SBY
10 NM
MSA SBY 25 NM
180°
2100
090°
1700
ENROUTE FACILITIES
BACK COURSE
HEBRO INT
SBY 10 DME
One minute
Holding Pattern
2000
314°
134°
136°
CHANN INT
SBY 5 DME
1200
SBY
3 DME
840
5 NM
4.7 NM
ELEV 52
136° 4.7 NM
from FAF
120
119
126
113
87
TDZE
48
5500
150
121
114
32

Disregard glide slope indications. Localizer (BC) unusable beyond 13 NM below 3500 feet.

MISSED APPROACH
Climbing left turn to 2000 via SBY R-035 then direct SBY VORTAC and hold.

| CATEGORY | A | B | C | D |
|---|---|---|---|---|
| S-14 | 840-1<br>792 (800-1) | 840-1¼<br>792 (800-1¼) | 840-2¼<br>792 (800-2¼) | 840-2½<br>792 (800-2½) |
| CIRCLING | 840-1<br>789 (800-1) | 840-1¼<br>789 (800-1¼) | 840-2¼<br>789 (800-2¼) | 840-2½<br>789 (800-2½) |
| DME MINIMA | | | | |
| S-14 | 400-1 352 (400-1) | | | 400-1¼<br>352 (400-1¼) |
| CIRCLING | 440-1<br>389 (400-1) | 520-1<br>469 (500-1) | 520-1½<br>469 (500-1½) | 620-2<br>569 (600-2) |

▲

REIL Rwys 5, 14 and 23
MIRL Rwys 5-23 and 14-32

FAF to MAP 4.7 NM

| Knots | 60 | 90 | 120 | 150 | 180 |
|---|---|---|---|---|---|
| Min:Sec | 4:42 | 3:08 | 2:21 | 1:53 | 1:34 |

LOC BC RWY 14

38°20'N - 75°31'W

SALISBURY, MARYLAND

SALISBURY-WICOMICO COUNTY REGIONAL (SBY)

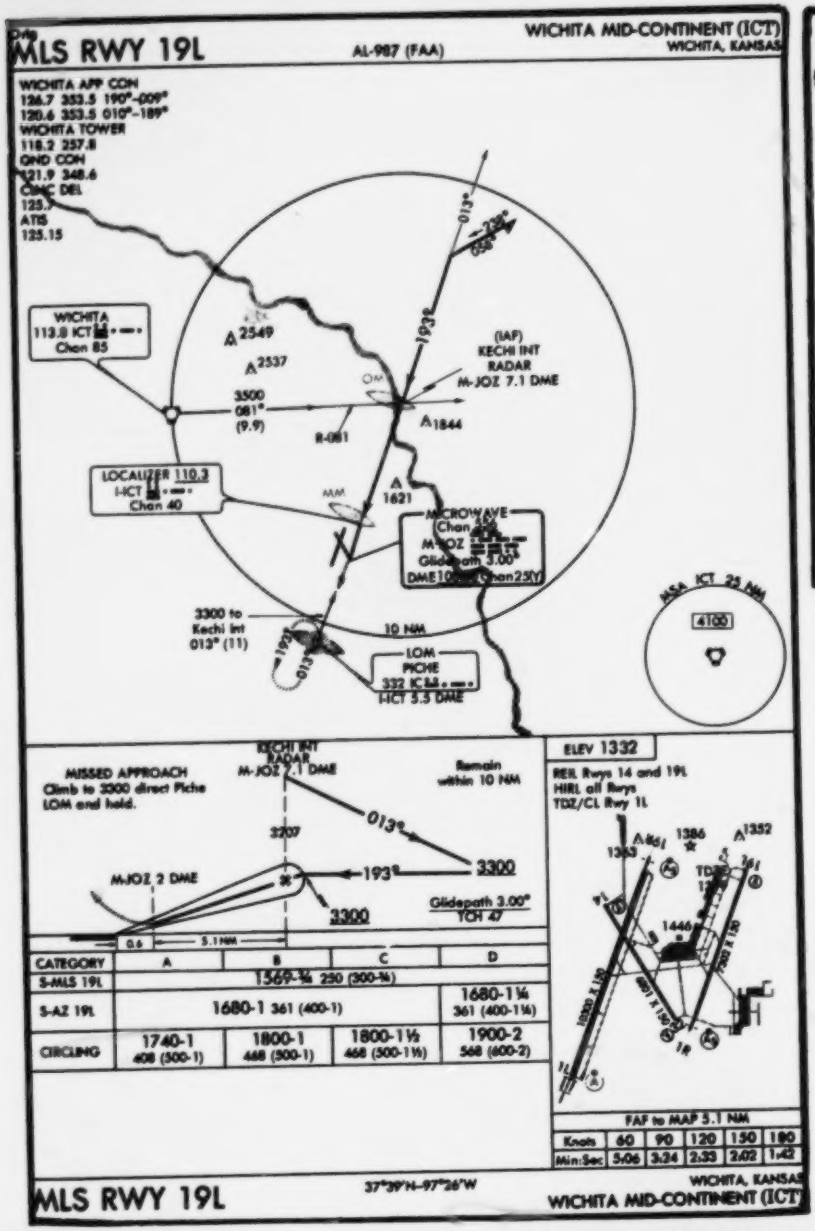
## MARYLAND

§ **SALISBURY-WICOMICO CO REGIONAL** (SBY) 4.3 SE UTC-5(-4DT) **WASHINGTON**
38°20'26"N 75°30'38"W **H-4J, 6H, L-22H, 24H, 27D, 28E**
52 B S4 **FUEL** 100LL, JET A CFR Index A **IAP**
**RWY 14-32:** H5500X150 (ASPH-CONC-PFC) S-34, D-54, DT-95 MIRL
**RWY 14:** REIL. VASI(V4L)—GA 3.0°TCH 54'. Trees. **RWY 32:** MALSR. Trees.
**RWY 05-23:** H5000X150 (ASPH) S-30, D-50 MIRL
**RWY 05:** REIL. VASI(V4L)—GA 3.0°TCH 39'. Trees. **RWY 23:** REIL. VASI(V4L)—GA 3.0°TCH 39'. Trees.
**AIRPORT REMARKS:** Attended 1100–0300Z‡. CAUTION: Birds on and in vicinity of arpt. Numerous military activities on and in vicinity of arpt Airport CLOSED to unscheduled air carrier ops with more than 30 passenger seats except 1 hour PPR call arpt manager 301-548-4827. Rwy 14 VASI unmonitored, key 123.6 5 times on and 3 times off. Rwy 14–32 middle third wire combed outer thirds PFC. Deer on airport. Numerous military activities on and in vicinity of arpt.
**COMMUNICATIONS: CTAF** 123.6 **UNICOM** 122.95
**SALISBURY FSS** (SBY) on arpt. 123.6 LC 742–8710. (1100–0300Z‡). NOTAM FILE SBY.
**LEESBURG FSS** (DCA) Toll free call dial 1–800–WX–BRIEF. (0300–1100Z‡).
**SALISBURY RCO** 122.1R 114.5T (NEWPORT NEWS)
**SALISBURY RCO** 122.3 122.2 (LEESBURG FSS)
Ⓡ **PATUXENT APP/DEP CON** 127.95 (1200-0400Z‡) **CLNC DEL** 118.55
Ⓡ **WASHINGTON CENTER APP/DEP CON** 127.7 (0400–1200Z‡)
**RADIO AIDS TO NAVIGATION:** NOTAM FILE SBY. VHF/DF ctc LEESBURG FSS
**(L) VORTAC** 111.2 SBY Chan 49 38°20'42"N 75°30'39"W at fld. 50/08W. VOR portion unusable 290°–320° beyond 10 NM below 3000'.
**COLBE NDB (LOM)** 278 SB 38°16'43"N 75°24'22"W 316° 5.7 NM to fld.
**ILS** 108.7 I-SBY Rwy 32 LOM COLBE NDB. BC unusable beyond 13 NM below 3500'.

▲

| NAME | ALTERNATE MINIMUMS |
|---|---|
| SALISBURY-WICOMICO COUNTY REGIONAL, MD | VOR Rwy 14*<br>LOC (BC) Rwy 14*<br>VOR Rwy 23**<br>*Category C, 800-2¼, Category D, 800-2½<br>**Category D, 800-2¼ |

FIGURE 27.—LOC BC RWY 14 (SBY) and Excerpt from A/FD.


MLS RWY 19L
AL-987 (FAA)
WICHITA MID-CONTINENT (ICT)
WICHITA, KANSAS
WICHITA APP CON
126.7 353.5 190°-009°
120.6 353.5 010°-189°
WICHITA TOWER
118.2 257.8
GND CON
121.9 348.6
CLNC DEL
125.7
ATIS
125.15
WICHITA
113.8 ICT
Chan 85
LOCALIZER 110.3
I-ICT
Chan 40
(IAF)
KECHI INT
RADAR
M-JOZ 7.1 DME
3500
081°
(9.9)
R-081
MICROWAVE
Chan 25Y
M-JOZ
Glidepath 3.00°
DME 109.2 Chan 25(Y)
3300 to
Kechi Int
013° (11)
10 NM
LOM
PICHE
332 IC
I-ICT 5.3 DME
MSA ICT 25 NM
4100
MISSED APPROACH
Climb to 3300 direct Piche LOM and hold.
Remain within 10 NM
M-JOZ 2 DME
Glidepath 3.00°
TCH 47
ELEV 1332
REIL Rwys 14 and 19L
HIRL all Rwys
TDZ/CL Rwy 1L
CATEGORY A B C D
S-MLS 19L 1569-¾ 250 (300-¾)
S-AZ 19L 1680-1 361 (400-1) 1680-1¼ 361 (400-1¼)
CIRCLING 1740-1 408 (500-1) 1800-1 468 (500-1) 1800-1½ 468 (500-1½) 1900-2 568 (600-2)
FAF to MAP 5.1 NM
Knots 60 90 120 150 180
Min:Sec 5:06 3:24 2:33 2:02 1:42
37°39'N-97°26'W

## KANSAS

**WICHITA MID-CONTINENT** (ICT) 5 SW UTC–6(-5DT) 37°39′00″N 97°25′58″W — **WICHITA** H-2J, 4F, L-6B IAP

1332 B S4 **FUEL** 100LL, JET A MOGAS OX 1, 2, 3, 4 LRA CFR Index C

**RWY 01L-19R:** H10,300X150 (CONC-GRVD) S-100, D-150, DT-250 HIRL CL

**RWY 01L:** ALSF2, TDZ. Antenna. **RWY 19R:** MALSR. Rgt tfc.

**RWY 01R-19L:** H7302X150 (CONC-GRVD) S-100, D-175, DT-300 HIRL

**RWY 01R:** MALSR. Rgt tfc. **RWY 19L:** REIL. VASI(V4L)—GA 3.0°TCH 55′. Antenna.

**RWY 14-32:** H6301X150 (CONC) S-100, D-150, DT-250 HIRL

**RWY 14:** REIL. VASI(V4L)—GA 3.0°TCH 52.5′. **RWY 32:** VASI(V4L)—GA 3.0°TCH 52′.

**AIRPORT REMARKS:** Attended continuously. Acft carrying hazardous or explosive cargo prohibited. Flight Notification Service (ADCUS) available.

**WEATHER DATA SOURCES:** LLWAS.

**COMMUNICATIONS:** **ATIS** 125.15 **UNICOM** 122.95

**WICHITA FSS** (ICT) on arpt 122.65, 122.2, 122.1R LC 942-4131. NOTAM FILE ICT.

Ⓡ **APP CON** 120.6 (010°–189°4500′ and below W IAB 010°–189°) 126.7 (190°–009°) 134.8 (E IAB 010°–189° 4500′ and below) 134.45 (010°–189° above 4500′)

**TOWER** 118.2 **GND CON** 121.9 **CLNC DEL** 125.7

Ⓡ **DEP CON** 120.6 (010°–189° 4500′ and below) 126.7 (190°–009°) 134.45 (010°–189° above 4500′) 124.75

**ARSA** ctc **APP CON**.

**RADIO AIDS TO NAVIGATION:** NOTAM FILE ICT.

(H) **VORTACW** 113.8 ICT Chan 85 37°44′43″N 97°35′01″W 121°9.1 NM to fld. 1470/7E

**PICHE NDB (H-SAB/LOM)** 332 ■ IC 37°34′42″N 97°27′20″W 012°4.1 NM to fld

**ILS/DME** 110.3 I-ICT Chan 40 Rwy 01R LOM PICHE NDB.

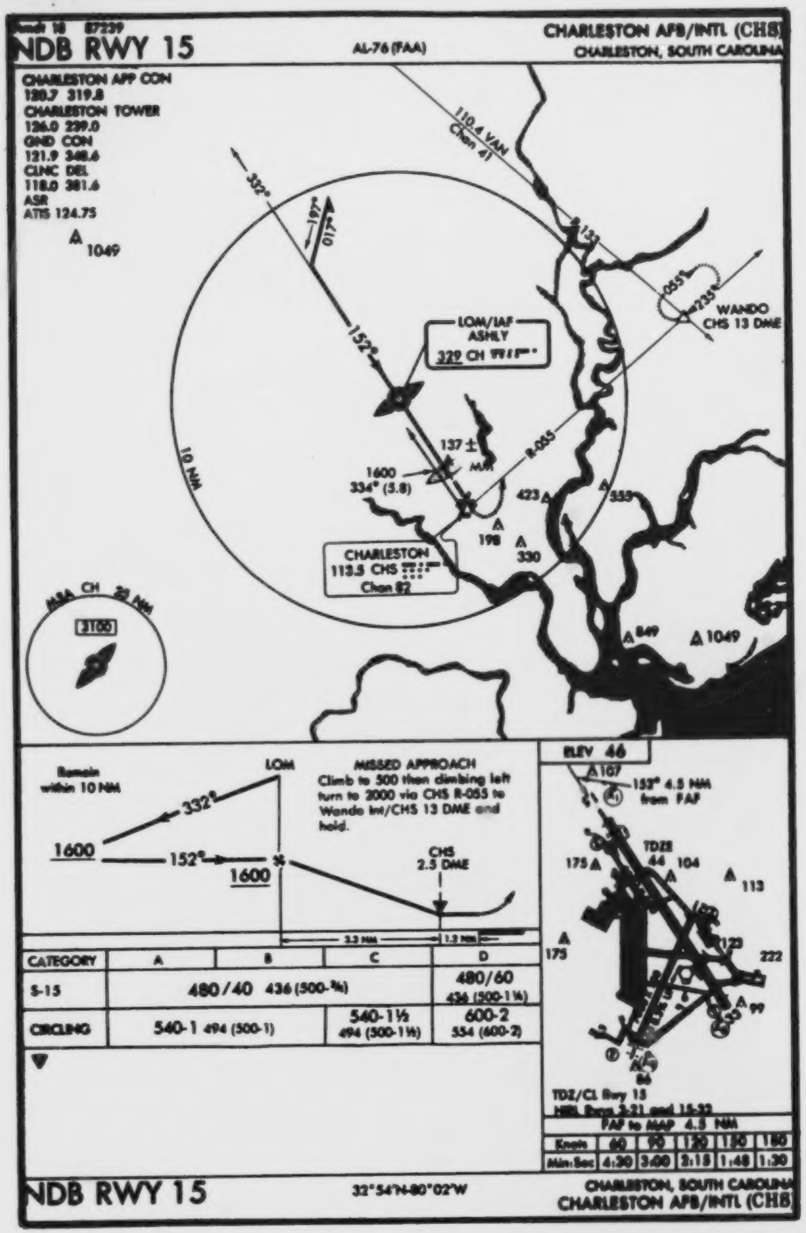
**ILS** 109.1 I-TWI Rwy 01L

**ILS** 110.5 I-HOV Rwy 19R.

**MLS** Chan 25Y Rwy 19L

**COMM/NAVAID REMARKS:** Emerg frequency 121.5 not avbl at FSS.

FIGURE 28.—MLS RWY 19L (ICT) and Excerpt from A/FD.

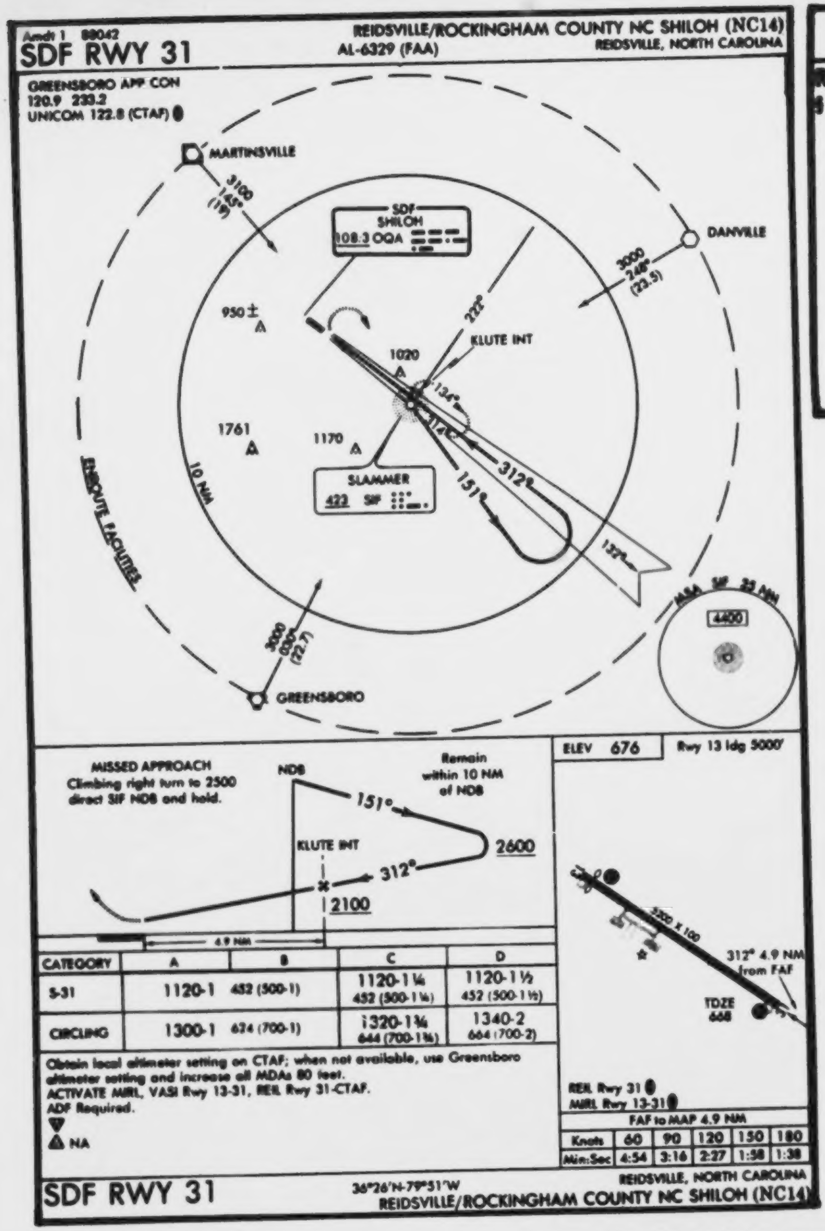

Amdt 10 87239
NDB RWY 15
AL-76 (FAA)
CHARLESTON AFB/INTL (CHS)
CHARLESTON, SOUTH CAROLINA
CHARLESTON APP CON
120.7 319.8
CHARLESTON TOWER
126.0 239.0
GND CON
121.9 348.6
CLNC DEL
118.0 381.6
ASR
ATIS 124.75
1049
332°
197°
017°
110.4 VAN
Chan 41
133
055°
235°
WANDO
CHS 13 DME
152°
LOM/IAF
ASHLY
329 CH
137
MAP
1600
334° (5.8)
R-055
423
555
198
330
10 NM
CHARLESTON
113.5 CHS
Chan 82
MSA CH 25 NM
3100
849
1049
Remain within 10 NM
LOM
MISSED APPROACH
Climb to 500 then climbing left turn to 2000 via CHS R-055 to Wando Int/CHS 13 DME and hold.
332°
1600
152°
1600
CHS
2.5 DME
3.3 NM
1.2 NM
CATEGORY
A
B
C
D
S-15
480/40 436 (500-¾)
480/60
436 (500-1¼)
CIRCLING
540-1 494 (500-1)
540-1½
494 (500-1½)
600-2
554 (600-2)
ELEV 46
107
152° 4.5 NM from FAF
TDZE 44
104
113
175
175
123
222
99
84
TDZ/CL Rwy 15
HIRL Rwys 3-21 and 15-33
FAF to MAP 4.5 NM
Knots 60 90 120 150 180
Min:Sec 4:30 3:00 2:15 1:48 1:30
NDB RWY 15
32°54'N-80°02'W
CHARLESTON, SOUTH CAROLINA
CHARLESTON AFB/INTL (CHS)

## SOUTH CAROLINA

### CHARLESTON

§ **CHARLESTON AFB/INTL** (CHS) 8.7 NW UTC-5(-4DT) 32°53'55"N 80°02'27"W **CHARLOTTE**
46 B S4 **FUEL** 100, JET A1 + OX 1 LRA CFR Index C H-6F, 4I, L-20G, 27A
**RWY 15-33:** H9001X200 (ASPH-CONC) S-125, D-275, DT-350, DDT-775 HIRL, CL IAP
**RWY 15:** ALSF1. TDZ. VASI(V12)—GA 3.0° TCH 53'. Trees. Arresting device.
**RWY 33:** VASI(V12)—GA 3.0° TCH 51'. Trees. Arresting device
**RWY 03-21:** H7000X150 (ASPH-CONC) S-125, D-275, DT-350, DDT-775 HIRL
**RWY 03:** SSALR, VASI(V12)—TCH 55'. Trees. **RWY 21:** VASI(V12)—TCH 45'. Trees.
**AIRPORT REMARKS:** Attended continuously. Rwy 15-33 CLOSED last Fri of each month 1230-2200Z‡. No student solo touch and go ldgs. Rwy braking action poor when wet due to rubber build-up. Taxiway 2 condition poor, surface rough and wavy. Flight Notification Service (ADCUS) available.
**WEATHER DATA SOURCES:** LLWAS.
**COMMUNICATIONS:** **ATIS** 124.75 **UNICOM** 122.95
**CHARLESTON FSS** (CHS) on arpt 122.5, 122.2, 122.1R 803-747-5293. NOTAM FILE CHS.
Ⓡ **APP CON** 120.7 (151°-330°) 135.8 (331°-150°) 119.3 Ⓡ **DEP CON** 120.7 (151°-330°) 135.8 (331°-150°)
**TOWER** 126.0 **GND CON** 121.9 **CLNC DEL** 118.0
**ARSA** ctc **APP CON**
**RADIO AIDS TO NAVIGATION:** NOTAM FILE CHS. VHF/DF Charleston FSS
(H) **VORTAC** 113.5 CHS Chan 82 32°53'39"N 80°02'17"W at fld. 40/05W
VOR unusable 001°-050° byd 20 NM blo 9000' 201°-216° byd 25 NM blo 8000'.
**ASHLY NDB (MH/LOM)** 329 CH 32°58'34"N 80°05'52"W 152° 4.5 NM to fld
**ILS** 109.7 I-CHS Rwy 15. LOM ASHLY NDB
**ILS** 108.9 I-CCI Rwy 33
**ASR**

FIGURE 29.—NDB RWY 15 (CHS) and Excerpt from A/FD.


Amdt 1 88042

**SDF RWY 31**

AL-6329 (FAA)

REIDSVILLE/ROCKINGHAM COUNTY NC SHILOH (NC14)

REIDSVILLE, NORTH CAROLINA

GREENSBORO APP CON
120.9 233.2
UNICOM 122.8 (CTAF)

MARTINSVILLE
3100
165°
(19)
SDF
SHILOH
108.3 OQA
DANVILLE
3000
248°
(23.5)
950±
222°
KLUTE INT
1020
134°
1761
1170
314°
312°
151°
SLAMMER
423 SIF
10 NM
ENROUTE FACILITIES
132°
MSA SIF 25 NM
4400
3000
030°
(22.7)
GREENSBORO
MISSED APPROACH
Climbing right turn to 2500 direct SIF NDB and hold.
NDB
151°
Remain within 10 NM of NDB
2600
KLUTE INT
312°
2100
4.9 NM
ELEV 676
Rwy 13 ldg 5000'
5200 X 100
312° 4.9 NM from FAF
TDZE 668
REIL Rwy 31
MIRL Rwy 13-31

| CATEGORY | A | B | C | D |
|---|---|---|---|---|
| S-31 | 1120-1 | 452 (500-1) | 1120-1¼<br>452 (500-1¼) | 1120-1½<br>452 (500-1½) |
| CIRCLING | 1300-1 | 624 (700-1) | 1320-1¾<br>644 (700-1¾) | 1340-2<br>664 (700-2) |

Obtain local altimeter setting on CTAF; when not available, use Greensboro altimeter setting and increase all MDAs 80 feet.
ACTIVATE MIRL, VASI Rwy 13-31, REIL Rwy 31-CTAF.
ADF Required.
▼
▲ NA

| FAF to MAP 4.9 NM | | | | | |
|---|---|---|---|---|---|
| Knots | 60 | 90 | 120 | 150 | 180 |
| Min:Sec | 4:54 | 3:16 | 2:27 | 1:58 | 1:38 |

**SDF RWY 31**

36°26'N-79°51'W

REIDSVILLE, NORTH CAROLINA

REIDSVILLE/ROCKINGHAM COUNTY NC SHILOH (NC14)

## NORTH CAROLINA

**REIDSVILLE**

**ROCKINGHAM CO NC SHILOH** (NC14) 7.8 NW UTC-5(-4DT) 36°26'09"N 79°50'58"W CINCINNATI H-6G, 4I, L-22G IAP

676 B S4 **FUEL** 100LL, JET A1 OX 3

**RWY 13-31:** H5200X100 (ASPH) S-12.5 MIRL

**RWY 13:** VASI(V2L)—GA 3.75°TCH 31.1'. Thld dsplcd 200'. Trees.

**RWY 31:** REIL. VASI(V2L)—GA 3.75°TCH 34'. Barn.

**AIRPORT REMARKS:** Attended Mon-Sat 1230Z‡-dusk, Sun 1800Z‡-dusk. Emergency repairs (919) 685-4423. For MIRL Rwy 13–31, VASI Rwys 13, 31 and REIL Rwy 31 key 122.8 3 times.

**COMMUNICATIONS:** CTAF/UNICOM 122.8

**RALEIGH FSS** (RDU) Toll free call dial 1-800-662-7272. NOTAM FILE RDU.

**GREENSBORO RCO** 123.65, 122.2, 122.1R 116.2T (RALEIGH FSS)

Ⓡ **GREENSBORO APP/DEP CON** 120.9

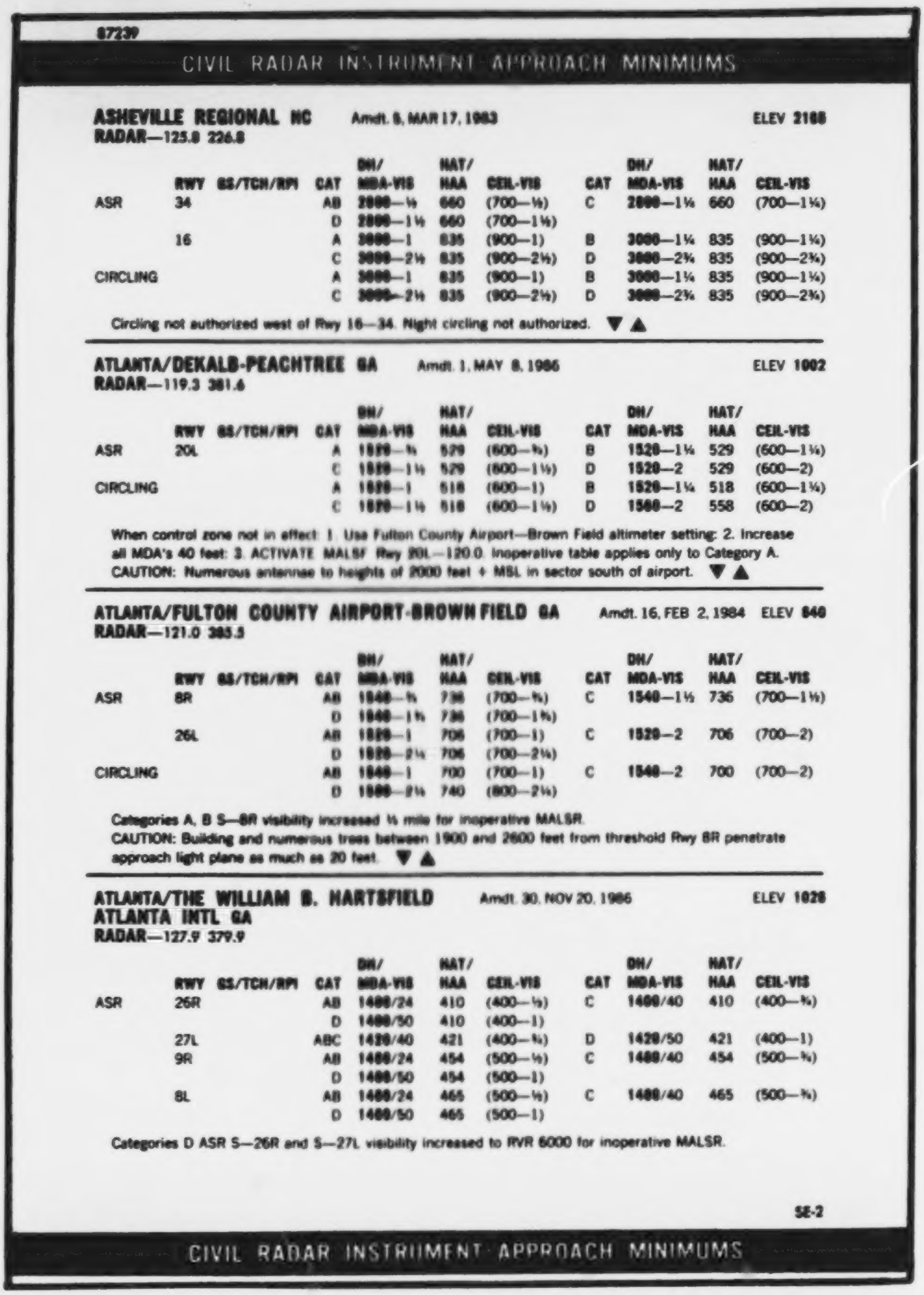
**RADIO AIDS TO NAVIGATION:** NOTAM FILE RDU.

**GREENSBORO (H) VORTAC** 116.2 GSO Chan 109 36°02'44"N 79°58'36"W 018°24.2 NM to fld. 880/03W. NOTAM FILE GSO.

**SLAMMER NDB (MHW)** 423 SIF 36°22'56"N 79°45'49"W 315°5 NM to fld.

**SDF** 108.3 OQA Rwy 31

FIGURE 30.—SDF RWY 31 (NC14) and Excerpt from A/FD.



87239

CIVIL RADAR INSTRUMENT APPROACH MINIMUMS

**ASHEVILLE REGIONAL NC** Amdt. 6, MAR 17, 1983 ELEV 2165
**RADAR**—125.8 226.8

| | RWY | GS/TCH/RPI | CAT | DH/ MDA-VIS | HAT/ HAA | CEIL-VIS | CAT | DH/ MDA-VIS | HAT/ HAA | CEIL-VIS |
|---|---|---|---|---|---|---|---|---|---|---|
| ASR | 34 | | AB | 2820—½ | 660 | (700—½) | C | 2820—1½ | 660 | (700—1½) |
| | | | D | 2820—1½ | 660 | (700—1½) | | | | |
| | 16 | | A | 3000—1 | 835 | (900—1) | B | 3000—1¼ | 835 | (900—1¼) |
| | | | C | 3000—2½ | 835 | (900—2½) | D | 3000—2¾ | 835 | (900—2¾) |
| CIRCLING | | | A | 3000—1 | 835 | (900—1) | B | 3000—1¼ | 835 | (900—1¼) |
| | | | C | 3000—2½ | 835 | (900—2½) | D | 3000—2¾ | 835 | (900—2¾) |

Circling not authorized west of Rwy 16—34. Night circling not authorized. ▼ ▲

**ATLANTA/DEKALB-PEACHTREE GA** Amdt. 1, MAY 8, 1986 ELEV 1002
**RADAR**—119.3 381.6

| | RWY | GS/TCH/RPI | CAT | DH/ MDA-VIS | HAT/ HAA | CEIL-VIS | CAT | DH/ MDA-VIS | HAT/ HAA | CEIL-VIS |
|---|---|---|---|---|---|---|---|---|---|---|
| ASR | 20L | | A | 1520—¾ | 529 | (600—¾) | B | 1520—1¼ | 529 | (600—1¼) |
| | | | C | 1520—1½ | 529 | (600—1½) | D | 1520—2 | 529 | (600—2) |
| CIRCLING | | | A | 1520—1 | 518 | (600—1) | B | 1520—1¼ | 518 | (600—1¼) |
| | | | C | 1520—1½ | 518 | (600—1½) | D | 1560—2 | 558 | (600—2) |

When control zone not in effect: 1. Use Fulton County Airport—Brown Field altimeter setting: 2. Increase all MDA's 40 feet: 3. ACTIVATE MALSF Rwy 20L—120.0. Inoperative table applies only to Category A.
CAUTION: Numerous antennae to heights of 2000 feet + MSL in sector south of airport. ▼ ▲

**ATLANTA/FULTON COUNTY AIRPORT-BROWN FIELD GA** Amdt. 16, FEB 2, 1984 ELEV 840
**RADAR**—121.0 385.5

| | RWY | GS/TCH/RPI | CAT | DH/ MDA-VIS | HAT/ HAA | CEIL-VIS | CAT | DH/ MDA-VIS | HAT/ HAA | CEIL-VIS |
|---|---|---|---|---|---|---|---|---|---|---|
| ASR | 8R | | AB | 1540—¾ | 736 | (700—¾) | C | 1540—1½ | 736 | (700—1½) |
| | | | D | 1540—1¾ | 736 | (700—1¾) | | | | |
| | 26L | | AB | 1520—1 | 706 | (700—1) | C | 1520—2 | 706 | (700—2) |
| | | | D | 1520—2¼ | 706 | (700—2¼) | | | | |
| CIRCLING | | | AB | 1540—1 | 700 | (700—1) | C | 1540—2 | 700 | (700—2) |
| | | | D | 1580—2¼ | 740 | (800—2¼) | | | | |

Categories A, B S—8R visibility increased ¼ mile for inoperative MALSR.
CAUTION: Building and numerous trees between 1900 and 2600 feet from threshold Rwy 8R penetrate approach light plane as much as 20 feet. ▼ ▲

**ATLANTA/THE WILLIAM B. HARTSFIELD ATLANTA INTL GA** Amdt. 30, NOV 20, 1986 ELEV 1026
**RADAR**—127.9 379.9

| | RWY | GS/TCH/RPI | CAT | DH/ MDA-VIS | HAT/ HAA | CEIL-VIS | CAT | DH/ MDA-VIS | HAT/ HAA | CEIL-VIS |
|---|---|---|---|---|---|---|---|---|---|---|
| ASR | 26R | | AB | 1400/24 | 410 | (400—½) | C | 1400/40 | 410 | (400—¾) |
| | | | D | 1400/50 | 410 | (400—1) | | | | |
| | 27L | | ABC | 1420/40 | 421 | (400—¾) | D | 1420/50 | 421 | (400—1) |
| | 9R | | AB | 1480/24 | 454 | (500—½) | C | 1480/40 | 454 | (500—¾) |
| | | | D | 1480/50 | 454 | (500—1) | | | | |
| | 8L | | AB | 1480/24 | 465 | (500—½) | C | 1480/40 | 465 | (500—¾) |
| | | | D | 1480/50 | 465 | (500—1) | | | | |

Categories D ASR S—26R and S—27L visibility increased to RVR 6000 for inoperative MALSR.

SE-2

CIVIL RADAR INSTRUMENT APPROACH MINIMUMS

FIGURE 31.—Civil Radar Instrument Approach Minimums.

| LOADING CONDITIONS | WT-1 | WT-2 | WT-3 | WT-4 | WT-5 |
|---|---|---|---|---|---|
| PASSENGERS | | | | | |
| FORWARD COMPT | 18 | 23 | 12 | 28 | 26 |
| AFT COMPT | 95 | 112 | 75 | 122 | 103 |
| CARGO | | | | | |
| FORWARD HOLD | 1,500 | 2,500 | 3,500 | 850 | 1,400 |
| AFT HOLD | 2,500 | 3,500 | 4,200 | 1,500 | 2,200 |
| FUEL | | | | | |
| TANKS 1 AND 3 (EACH) | 10,500 | 11,000 | FULL | 10,000 | 11,500 |
| TANK 2 | 28,000 | 27,000 | 24,250 | 26,200 | 25,200 |

FIGURE 32.—B-727 Loading.

| LOADING CONDITIONS | WT-6 | WT-7 | WT-8 | WT-9 | WT-10 |
|---|---|---|---|---|---|
| PASSENGERS | | | | | |
| FORWARD COMPT | 10 | 27 | 6 | 29 | 21 |
| AFT COMPT | 132 | 83 | 98 | 133 | 127 |
| CARGO | | | | | |
| FORWARD HOLD | 5,000 | 4,500 | 1,300 | 975 | 2,300 |
| AFT HOLD | 6,000 | 5,500 | 3,300 | 1,250 | 2,400 |
| FUEL | | | | | |
| TANKS 1 AND 3 (EACH) | 9,500 | 9,000 | FULL | 11,000 | 10,500 |
| TANK 2 | 21,700 | 19,800 | 12,000 | 29,300 | 22,700 |

FIGURE 33.—B-727 Loading.

| LOADING CONDITIONS | WT-11 | WT-12 | WT-13 | WT-14 | WT-15 |
|---|---|---|---|---|---|
| PASSENGERS | | | | | |
| FORWARD COMPT | 11 | 28 | 22 | 17 | 3 |
| AFT COMPT | 99 | 105 | 76 | 124 | 130 |
| CARGO | | | | | |
| FORWARD HOLD | 3,100 | 4,200 | 1,600 | 3,800 | 1,800 |
| AFT HOLD | 5,500 | 4,400 | 5,700 | 4,800 | 3,800 |
| FUEL | | | | | |
| TANKS 1 AND 3 (EACH) | 8,500 | 11,500 | 12,000 | 11,000 | 10,500 |
| TANK 2 | 19,600 | 27,800 | 29,100 | 25,400 | 21,900 |

FIGURE 34.—B-727 Loading.

**AIRPLANE DATUM CONSTANTS**

| | |
|---|---|
| MAC- | 180.9 inches |
| L.E. of MAC- | 860.5 inches |
| Basic Operating Index- | $\frac{92,837.0}{1,000}$ |

**OPERATING LIMITATIONS**

| | |
|---|---|
| Maximum Takeoff Slope- | ± 2% |
| Maximum Takeoff/Landing Crosswind Component- | 32 knots |
| Maximum Takeoff/Landing Tailwind Component | 12 knots |

**WEIGHT LIMITATIONS**

| | |
|---|---|
| Basic Operating Weight | 105,500 pounds |
| Maximum Zero Fuel Weight | 138,500 pounds |
| Maximum Taxi Weight- | 185,700 pounds |
| Maximum Takeoff Weight (Brake Release) | 184,700 pounds |
| Maximum Inflight Weight (Flaps 30) | 155,500 pounds |
| (Flaps 40) | 144,000 pounds |
| Maximum Landing Weight (Flaps 30)- | 155,000 pounds |
| (Flaps 40)- | 143,000 pounds |

FIGURE 35.—Table of Weights and Limits.

## PASSENGER LOADING TABLE

| Number of Pass. | Weight Lbs. | $\frac{\text{Moment}}{1000}$ |
|---|---|---|
| **FORWARD COMPARTMENT CENTROID—582.0** | | |
| 5 | 850 | 495 |
| 10 | 1,700 | 989 |
| 15 | 2,550 | 1,484 |
| 20 | 3,400 | 1,979 |
| 25 | 4,250 | 2,473 |
| 29 | 4,930 | 2,869 |
| **AFT COMPARTMENT CENTROID—1028.0** | | |
| 10 | 1,700 | 1,748 |
| 20 | 3,400 | 3,495 |
| 30 | 5,100 | 5,243 |
| 40 | 6,800 | 6,990 |
| 50 | 8,500 | 8,738 |
| 60 | 10,200 | 10,486 |
| 70 | 11,900 | 12,233 |
| 80 | 13,600 | 13,980 |
| 90 | 15,300 | 15,728 |
| 100 | 17,000 | 17,476 |
| 110 | 18,700 | 19,223 |
| 120 | 20,400 | 20,971 |
| 133 | 22,610 | 23,243 |

## CARGO LOADING TABLE

| | $\frac{\text{Moment}}{1000}$ | |
|---|---|---|
| Weight Lbs. | Forward Hold Arm 680.0 | Aft Hold Arm 1166.0 |
| 6,000 | | 6,966 |
| 5,000 | 3,400 | 5,830 |
| 4,000 | 2,720 | 4,664 |
| 3,000 | 2,040 | 3,498 |
| 2,000 | 1,360 | 2,332 |
| 1,000 | 680 | 1,166 |
| 900 | 612 | 1,049 |
| 800 | 544 | 933 |
| 700 | 476 | 816 |
| 600 | 408 | 700 |
| 500 | 340 | 583 |
| 400 | 272 | 466 |
| 300 | 204 | 350 |
| 200 | 136 | 233 |
| 100 | 68 | 117 |

NOTE: THESE COMPUTATIONS ARE TO BE USED FOR TESTING PURPOSES ONLY.

## FUEL LOADING TABLE

| TANKS 1 & 3 (EACH) | | | TANK 2 (3 CELL) | | | | | |
|---|---|---|---|---|---|---|---|---|
| Weight Lbs. | Arm | $\frac{\text{Moment}}{1000}$ | Weight Lbs. | Arm | $\frac{\text{Moment}}{1000}$ | Weight Lbs. | Arm | $\frac{\text{Moment}}{1000}$ |
| 8,500 | 992.1 | 8,433 | 8,500 | 917.5 | 7,799 | 22,500 | 914.5 | 20,576 |
| 9,000 | 993.0 | 8,937 | 9,000 | 917.2 | 8,255 | 23,000 | 914.5 | 21,034 |
| 9,500 | 993.9 | 9,442 | 9,500 | 917.0 | 8,711 | 23,500 | 914.4 | 21,488 |
| 10,000 | 994.7 | 9,947 | 10,000 | 916.8 | 9,168 | 24,000 | 914.3 | 21,943 |
| 10,500 | 995.4 | 10,451 | 10,500 | 916.6 | 9,624 | 24,500 | 914.3 | 22,400 |
| 11,000 | 996.1 | 10,957 | 11,000 | 916.5 | 10,082 | 25,000 | 914.2 | 22,855 |
| 11,500 | 996.8 | 11,463 | 11,500 | 916.3 | 10,537 | 25,500 | 914.2 | 23,312 |
| 12,000 | 997.5 | 11,970 | 12,000 | 916.1 | 10,993 | 26,000 | 914.1 | 23,767 |
| FULL CAPACITY | | | **(See note at lower left) | | | 26,500 | 914.1 | 24,244 |
| **Note: Computations for Tank 2 weights for 12,500 lbs. to 18,000 lbs. have been purposely omitted. | | | 18,500 | 915.1 | 16,929 | 27,000 | 914.0 | 24,678 |
| | | | 19,000 | 915.0 | 17,385 | 27,500 | 913.9 | 25,132 |
| | | | 19,500 | 914.9 | 17,841 | 28,000 | 913.9 | 25,589 |
| | | | 20,000 | 914.9 | 18,298 | 28,500 | 913.8 | 26.043 |
| | | | 20,500 | 014.8 | 18,753 | 29,000 | 913.7 | 26,497 |
| | | | 21,000 | 914.7 | 19,209 | 29,500 | 913.7 | 26,954 |
| | | | 21,500 | 914.6 | 19,664 | 30,000 | 913.6 | 27,408 |
| | | | 22,000 | 914.6 | 20,121 | FULL CAPACITY | | |

FIGURE 36.—Loading Tables.

| LOADING CONDITIONS | WS-1 | WS-2 | WS-3 | WS-4 | WS-5 |
|---|---|---|---|---|---|
| LOADED WEIGHT | 90,000 | 85,000 | 84,500 | 81,700 | 88,300 |
| LOADED CG (% MAC) | 22.5% | 28.4% | 19.8% | 30.3% | 25.5% |
| WEIGHT CHANGE (POUNDS) | 2,500 | 1,800 | 3,000 | 2,100 | 3,300 |

FWD COMPT CENTROID - STA 352.1 AND -227.9 INDEX ARM
AFT COMPT CENTROID - STA 724.9 AND +144.9 INDEX ARM
MAC - 141.5 INCHES, LEMAC - STA 549.13, AND -30.87 INDEX ARM

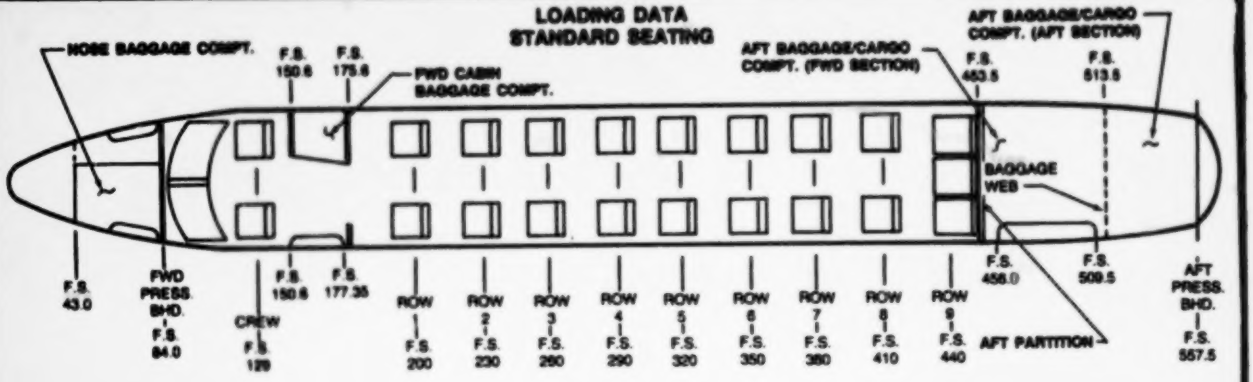
FIGURE 37.—DC-9 Weight Shift.

| LOADING CONDITIONS | BE-1 | BE-2 | BE-3 | BE-4 | BE-5 |
|---|---|---|---|---|---|
| CREW | 360 | 340 | 350 | 340 | 360 |
| PASSENGERS | | | | | |
| ROW 1 | 350 | 300 | 120 | - | - |
| ROW 2 | 260 | 250 | 340 | 370 | - |
| ROW 3 | 200 | 190 | 350 | 400 | 170 |
| ROW 4 | 340 | 170 | 300 | 290 | 200 |
| ROW 5 | 120 | 190 | 170 | 200 | 290 |
| ROW 6 | 400 | 340 | - | 170 | 400 |
| ROW 7 | 120 | 190 | - | 210 | 370 |
| ROW 8 | 250 | - | - | 190 | 340 |
| ROW 9 | - | - | - | 420 | 430 |
| BAGGAGE | | | | | |
| NOSE | 60 | - | 80 | - | 100 |
| FWD CABIN | 250 | 100 | 120 | - | 200 |
| AFT (FWD SEC) | 500 | 200 | 250 | 800 | - |
| AFT (AFT SEC) | - | 600 | 500 | - | - |
| FUEL | | | | | |
| GAL | 370 | 390 | 400 | 290 | 340 |
| TYPE | JET B | JET A | JET B | JET A | JET B |
| TEMP | +5° C | +15° C | -15° C | +10° C | +25° C |

FIGURE 38.—Beech 1900 Loading Passenger Configuration.

| LOADING CONDITIONS | BE-6 | BE-7 | BE-8 | BE-9 | BE-10 |
|---|---|---|---|---|---|
| CREW | 360 | 340 | 350 | 370 | 420 |
| CARGO SECTION<br>A | 500 | - | 600 | 600 | 350 |
| B | 500 | 400 | 200 | 600 | 450 |
| C | 550 | 450 | 400 | 600 | 450 |
| D | 550 | 600 | 400 | 600 | 550 |
| E | 600 | 600 | 200 | 550 | 550 |
| F | 600 | 600 | 200 | 350 | 600 |
| G | 450 | 500 | 200 | 250 | 600 |
| H | - | - | 200 | 250 | - |
| J | 350 | - | 300 | 150 | - |
| K | - | - | 260 | 200 | - |
| L | - | - | 100 | 100 | - |
| FUEL<br>GAL | 340 | 370 | 390 | 290 | 400 |
| TYPE | JET B | JET B | JET A | JET A | JET B |
| TEMP | +25° C | +5° C | +15° C | +10° C | -15° C |
| BASIC OPERATING WEIGHT - 9,005 POUNDS, 25,934 MOM/100 | | | | | |

FIGURE 39.—Beech 1900 Loading Cargo Configuration.


LOADING DATA
STANDARD SEATING
NOSE BAGGAGE COMPT.
F.S. 150.6
F.S. 175.6
FWD CABIN BAGGAGE COMPT.
AFT BAGGAGE/CARGO COMPT. (FWD SECTION)
AFT BAGGAGE/CARGO COMPT. (AFT SECTION)
F.S. 483.5
F.S. 513.5
BAGGAGE WEB
F.S. 43.0
FWD PRESS. BHD.
F.S. 84.0
CREW
F.S. 129
F.S. 150.6
F.S. 177.35
ROW 1
F.S. 200
ROW 2
F.S. 230
ROW 3
F.S. 260
ROW 4
F.S. 290
ROW 5
F.S. 320
ROW 6
F.S. 350
ROW 7
F.S. 380
ROW 8
F.S. 410
ROW 9
F.S. 440
F.S. 456.0
F.S. 509.5
AFT PARTITION
AFT PRESS. BHD.
F.S. 557.5

| BAGGAGE/CARGO LOCATION | | CAPACITY - POUNDS | CENTROID (FUSELAGE STATION) |
|---|---|---|---|
| NOSE BAGGAGE COMPARTMENT | | 150 | 65.5 |
| FORWARD CABIN BAGGAGE COMPARTMENT (INCLUDES UP TO 100 POUNDS WHICH MAY BE SUSPENDED FROM CLOTHES ROD) | | 250 | 163.6 |
| AFT BAGGAGE/CARGO COMPARTMENT | - FWD SECTION | 880 | 483.5 |
| | - AFT SECTION | 630 | 533.0 |

**NOTE:**

1. For compartment loadings which result in only partial utilization of total compartment volume, load items must be distributed or secured in a manner to preclude shifting under normally anticipated operating conditions.

**BASIC EMPTY WEIGHT** 9,226 LB.

**BASIC MOMENT/100** 25823

FIGURE 40.—Airplane - Loading Data.

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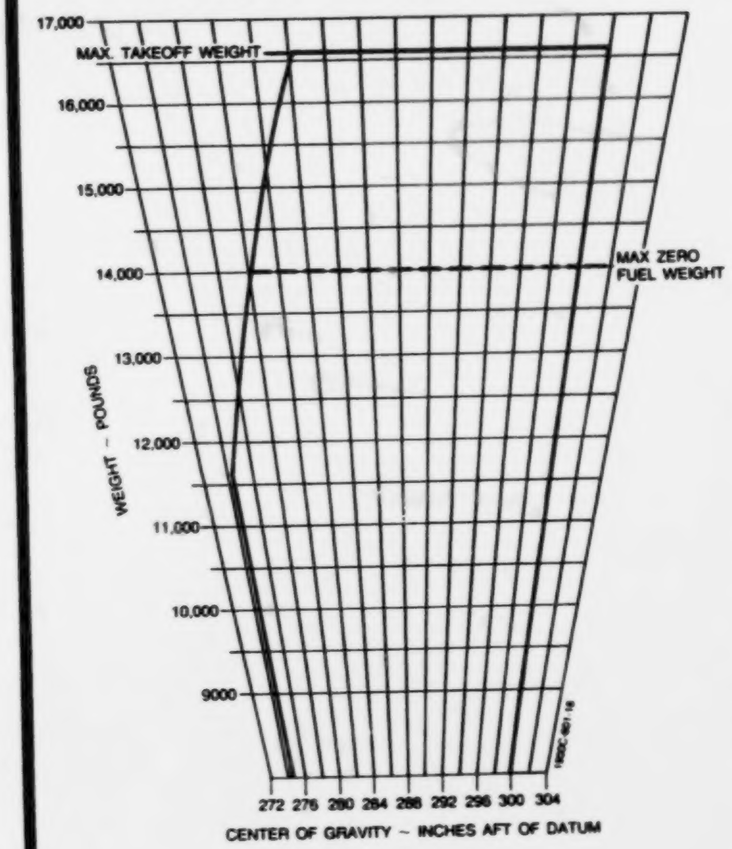
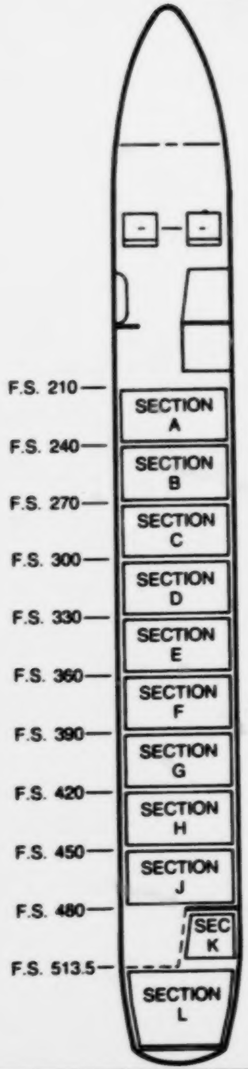
## WEIGHT AND BALANCE DIAGRAM



MAX TAKEOFF WEIGHT – 16,000 lb
MAX LANDING WEIGHT – 16,000 lb
MAX ZERO FUEL WEIGHT – 16,000 lb

## LOADING DATA
## CARGO CONFIGURATION


F.S. 210
F.S. 240
F.S. 270
F.S. 300
F.S. 330
F.S. 360
F.S. 390
F.S. 420
F.S. 450
F.S. 480
F.S. 513.5
SECTION A
SECTION B
SECTION C
SECTION D
SECTION E
SECTION F
SECTION G
SECTION H
SECTION J
SEC K
SECTION L

| SECTION | MAXIMUM STRUCTURAL CAPACITY | CENTROID ARM |
|---|---|---|
| A | 600 | F.S. 225 |
| B | 600 | F.S. 255 |
| C | 600 | F.S. 285 |
| D | 600 | F.S. 315 |
| E | 600 | F.S. 345 |
| F | 600 | F.S. 375 |
| G | 600 | F.S. 405 |
| H | 600 | F.S. 435 |
| J | 600 | F.S. 465 |
| K | 250 | F.S. 499.5 |
| L | 565 | F.S. 533 |

NOTES:

1. ALL CARGO IN SECTIONS A THROUGH J MUST BE SUPPORTED ON THE SEAT TRACKS AND SECURED TO THE SEAT TRACKS AND SIDE SEAT RAILS BY AN FAA APPROVED SYSTEM.
2. CONCENTRATED CARGO LOADS IN SECTIONS A THROUGH L MUST NOT EXCEED 100 LBS. PER SQUARE FOOT.
3. CARGO IN SECTIONS K AND L MUST BE RETAINED BY BAGGAGE WEBS AND PARTITIONS PROVIDED AS PART OF STANDARD AIRPLANE.
4. ANY EXCEPTIONS TO THE ABOVE PROCEDURES WILL REQUIRE APPROVAL BY A LOCAL FAA OFFICE.

1900-603-50

FIGURE 41.—CG Envelope and Cargo Loading Data.

## USEFUL LOAD WEIGHTS AND MOMENTS

### BAGGAGE

| WEIGHT | NOSE BAGGAGE COMPARTMENT F.S. 65.5 | FORWARD CABIN BAGGAGE COMPARTMENT F.S. 163.6 | AFT BAGGAGE/ CARGO COMPARTMENT (FORWARD SECTION) F.S. 483.5 | AFT BAGGAGE/ CARGO COMPARTMENT (AFT SECTION) F.S. 533.0 |
|---|---|---|---|---|
|  | MOMENT/100 |  |  |  |
| 10 | 7 | 16 | 48 | 53 |
| 20 | 13 | 33 | 97 | 107 |
| 30 | 20 | 49 | 145 | 160 |
| 40 | 26 | 65 | 193 | 213 |
| 50 | 33 | 82 | 242 | 266 |
| 60 | 39 | 98 | 290 | 320 |
| 70 | 46 | 115 | 338 | 373 |
| 80 | 52 | 131 | 387 | 426 |
| 90 | 59 | 147 | 435 | 480 |
| 100 | 66 | 164 | 484 | 533 |
| 150 | 98 | 245 | 725 | 800 |
| 200 |  | 327 | 967 | 1066 |
| 250 |  | 409 | 1209 | 1332 |
| 300 |  |  | 1450 | 1599 |
| 350 |  |  | 1692 | 1866 |
| 400 |  |  | 1934 | 2132 |
| 450 |  |  | 2176 | 2398 |
| 500 |  |  | 2418 | 2665 |
| 550 |  |  | 2659 | 2932 |
| 600 |  |  | 2901 | 3198 |
| 630 |  |  | 3046 | 3358 |
| 650 |  |  | 3143 |  |
| 700 |  |  | 3384 |  |
| 750 |  |  | 3626 |  |
| 800 |  |  | 3868 |  |
| 850 |  |  | 4110 |  |
| 880 |  |  | 4255 |  |

FIGURE 42.—Airplane - Weights and Moments - Baggage.

## USEFUL LOAD WEIGHTS AND MOMENTS

### OCCUPANTS

| WEIGHT | CREW | CABIN SEATS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | F.S. 129 | F.S. 200 | F.S. 230 | F.S. 260 | F.S. 290 | F.S. 320 | F.S. 350 | F.S. 380 | F.S. 410 | F.S. 440 |
| | MOMENT/100 | | | | | | | | | |
| 80 | 103 | 160 | 184 | 208 | 232 | 256 | 280 | 304 | 328 | 352 |
| 90 | 116 | 180 | 207 | 234 | 261 | 288 | 315 | 342 | 369 | 396 |
| 100 | 129 | 200 | 230 | 260 | 290 | 320 | 350 | 380 | 410 | 440 |
| 110 | 142 | 220 | 253 | 286 | 319 | 352 | 385 | 418 | 451 | 484 |
| 120 | 155 | 240 | 276 | 312 | 348 | 384 | 420 | 456 | 492 | 528 |
| 130 | 168 | 260 | 299 | 338 | 377 | 416 | 455 | 494 | 533 | 572 |
| 140 | 181 | 280 | 322 | 364 | 406 | 448 | 490 | 532 | 574 | 616 |
| 150 | 194 | 300 | 345 | 390 | 435 | 480 | 525 | 570 | 615 | 660 |
| 160 | 206 | 320 | 368 | 416 | 464 | 512 | 560 | 608 | 656 | 704 |
| 170 | 219 | 340 | 391 | 442 | 493 | 544 | 595 | 646 | 697 | 748 |
| 180 | 232 | 360 | 414 | 468 | 522 | 576 | 630 | 684 | 738 | 792 |
| 190 | 245 | 380 | 437 | 494 | 551 | 608 | 665 | 722 | 779 | 836 |
| 200 | 258 | 400 | 460 | 520 | 580 | 640 | 700 | 760 | 820 | 880 |
| 210 | 271 | 420 | 483 | 546 | 609 | 672 | 735 | 798 | 861 | 924 |
| 220 | 284 | 440 | 506 | 572 | 638 | 704 | 770 | 836 | 902 | 968 |
| 230 | 297 | 460 | 529 | 598 | 667 | 736 | 805 | 874 | 943 | 1012 |
| 240 | 310 | 480 | 552 | 624 | 696 | 768 | 840 | 912 | 984 | 1056 |
| 250 | 323 | 500 | 575 | 650 | 725 | 800 | 875 | 950 | 1025 | 1100 |

Note: Weights reflected in above table represent weight per seat.

FIGURE 43.—Airplane - Weights and Moments - Occupants.

# DENSITY VARIATION OF AVIATION FUEL

## BASED ON AVERAGE SPECIFIC GRAVITY

| FUEL | AVERAGE SPECIFIC GRAVITY AT 15°C (59°F) |
|---|---|
| AVIATION KEROSENE JET A AND JET A1 | .812 |
| JET B (JP-4) | .785 |
| AV GAS GRADE 100/130 | .703 |

NOTE: The Fuel Quantity Indicator is calibrated for correct indication when using Aviation Kerosene Jet A and Jet A1. When using other fuels, multiply the indicated fuel quantity in pounds by .99 for Jet B (JP-4) or by .98 for Aviation Gasoline (100/130) to obtain actual fuel quantity in pounds.

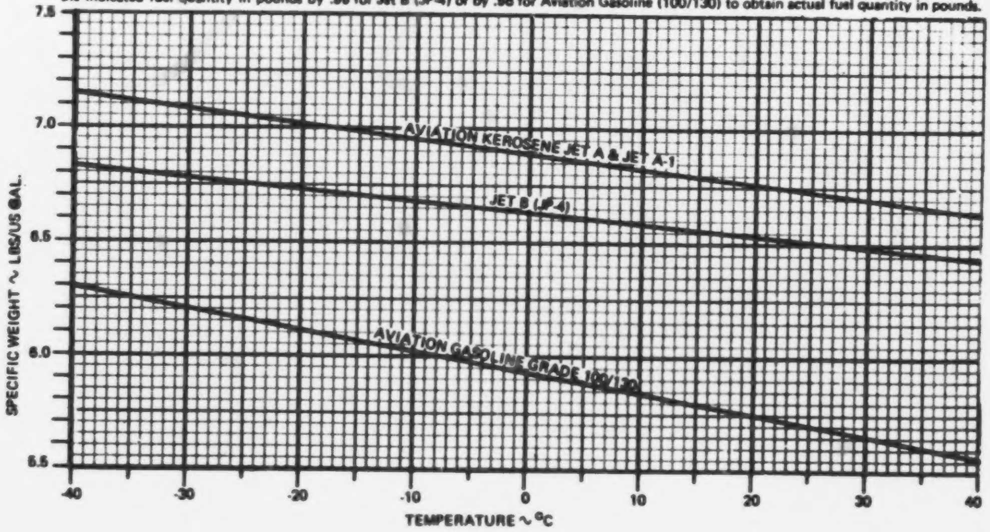


FIGURE 44.—Density Variation of Aviation Fuel.

## USEFUL LOAD WEIGHTS AND MOMENTS

### USABLE FUEL

| GALLONS | 6.5 LB/GAL | | 6.6 LB/GAL | | 6.7 LB/GAL | | 6.8 LB/GAL | |
|---|---|---|---|---|---|---|---|---|
| | WEIGHT | MOMENT / 100 | WEIGHT | MOMENT / 100 | WEIGHT | MOMENT / 100 | WEIGHT | MOMENT / 100 |
| 10 | 65 | 197 | 66 | 200 | 67 | 203 | 68 | 206 |
| 20 | 130 | 394 | 132 | 401 | 134 | 407 | 136 | 413 |
| 30 | 195 | 592 | 198 | 601 | 201 | 610 | 204 | 619 |
| 40 | 260 | 789 | 264 | 802 | 268 | 814 | 272 | 826 |
| 50 | 325 | 987 | 330 | 1002 | 335 | 1018 | 340 | 1033 |
| 60 | 390 | 1185 | 396 | 1203 | 402 | 1222 | 408 | 1240 |
| 70 | 455 | 1383 | 462 | 1404 | 469 | 1426 | 476 | 1447 |
| 80 | 520 | 1581 | 528 | 1605 | 536 | 1630 | 544 | 1654 |
| 90 | 585 | 1779 | 594 | 1806 | 603 | 1834 | 612 | 1861 |
| 100 | 650 | 1977 | 660 | 2007 | 670 | 2038 | 680 | 2068 |
| 110 | 715 | 2175 | 726 | 2208 | 737 | 2242 | 748 | 2275 |
| 120 | 780 | 2372 | 792 | 2409 | 804 | 2445 | 816 | 2482 |
| 130 | 845 | 2569 | 858 | 2608 | 871 | 2648 | 884 | 2687 |
| 140 | 910 | 2765 | 924 | 2808 | 938 | 2850 | 952 | 2893 |
| 150 | 975 | 2962 | 990 | 3007 | 1005 | 3053 | 1020 | 3099 |
| 160 | 1040 | 3157 | 1056 | 3205 | 1072 | 3254 | 1088 | 3303 |
| 170 | 1105 | 3351 | 1122 | 3403 | 1139 | 3454 | 1156 | 3506 |
| 180 | 1170 | 3545 | 1188 | 3600 | 1206 | 3654 | 1224 | 3709 |
| 190 | 1235 | 3739 | 1254 | 3797 | 1273 | 3854 | 1292 | 3912 |
| 200 | 1300 | 3932 | 1320 | 3992 | 1340 | 4053 | 1360 | 4113 |
| 210 | 1365 | 4124 | 1386 | 4187 | 1407 | 4250 | 1428 | 4314 |
| 220 | 1430 | 4315 | 1452 | 4382 | 1474 | 4448 | 1496 | 4514 |
| 230 | 1495 | 4507 | 1518 | 4576 | 1541 | 4646 | 1564 | 4715 |
| 240 | 1560 | 4698 | 1584 | 4770 | 1608 | 4843 | 1632 | 4915 |
| 250 | 1625 | 4889 | 1650 | 4964 | 1675 | 5040 | 1700 | 5115 |
| 260 | 1690 | 5080 | 1716 | 5158 | 1742 | 5236 | 1768 | 5315 |
| 270 | 1755 | 5271 | 1782 | 5352 | 1809 | 5433 | 1836 | 5514 |
| 280 | 1820 | 5462 | 1848 | 5546 | 1876 | 5630 | 1904 | 5714 |
| 290 | 1885 | 5651 | 1914 | 5738 | 1943 | 5825 | 1972 | 5912 |
| 300 | 1950 | 5842 | 1980 | 5932 | 2010 | 6022 | 2040 | 6112 |
| 310 | 2015 | 6032 | 2046 | 6125 | 2077 | 6218 | 2108 | 6311 |
| 320 | 2080 | 6225 | 2112 | 6321 | 2144 | 6416 | 2176 | 6512 |
| 330 | 2145 | 6417 | 2178 | 6516 | 2211 | 6615 | 2244 | 6713 |
| 340 | 2210 | 6610 | 2244 | 6711 | 2278 | 6813 | 2312 | 6915 |
| 350 | 2275 | 6802 | 2310 | 6907 | 2345 | 7011 | 2380 | 7116 |
| 360 | 2340 | 6995 | 2376 | 7103 | 2412 | 7210 | 2448 | 7318 |
| 370 | 2405 | 7188 | 2442 | 7299 | 2479 | 7409 | 2516 | 7520 |
| 380 | 2470 | 7381 | 2508 | 7495 | 2546 | 7609 | 2584 | 7722 |
| 390 | 2535 | 7575 | 2574 | 7691 | 2613 | 7808 | 2652 | 7924 |
| 400 | 2600 | 7768 | 2640 | 7888 | 2680 | 8007 | 2720 | 8127 |
| 410 | 2665 | 7962 | 2706 | 8085 | 2747 | 8207 | 2788 | 8330 |
| 420 | 2730 | 8156 | 2772 | 8282 | 2814 | 8407 | 2856 | 8532 |
| 425 | 2763 | 8259 | 2805 | 8366 | 2848 | 8513 | 2890 | 8640 |

FIGURE 45.—Airplane - Weights and Moments - Usable Fuel.

| OPERATING CONDITIONS | BE-11 | BE-12 | BE-13 | BE-14 | BE-15 |
|---|---|---|---|---|---|
| BASIC EMPTY WT | | | | | |
| WEIGHT | 9,225 | 9,100 | 9,000 | 8,910 | 9,150 |
| MOM/100 | 25,820 | 24,990 | 24,710 | 24,570 | 25,240 |
| CREW WEIGHT | 340 | 380 | 360 | 400 | 370 |
| PASS AND BAG | | | | | |
| WEIGHT | 4,200 | 4,530 | 4,630 | 4,690 | 4,500 |
| MOM/100 | 15,025 | 16,480 | 16,743 | 13,724 | 13,561 |
| FUEL (6.8 LB/GAL) | | | | | |
| RAMP LOAD - GAL | 360 | 320 | 340 | 310 | 410 |
| USED START AND TAXI | 20 | 20 | 10 | 20 | 30 |
| REMAIN AT LDG | 100 | 160 | 140 | 100 | 120 |

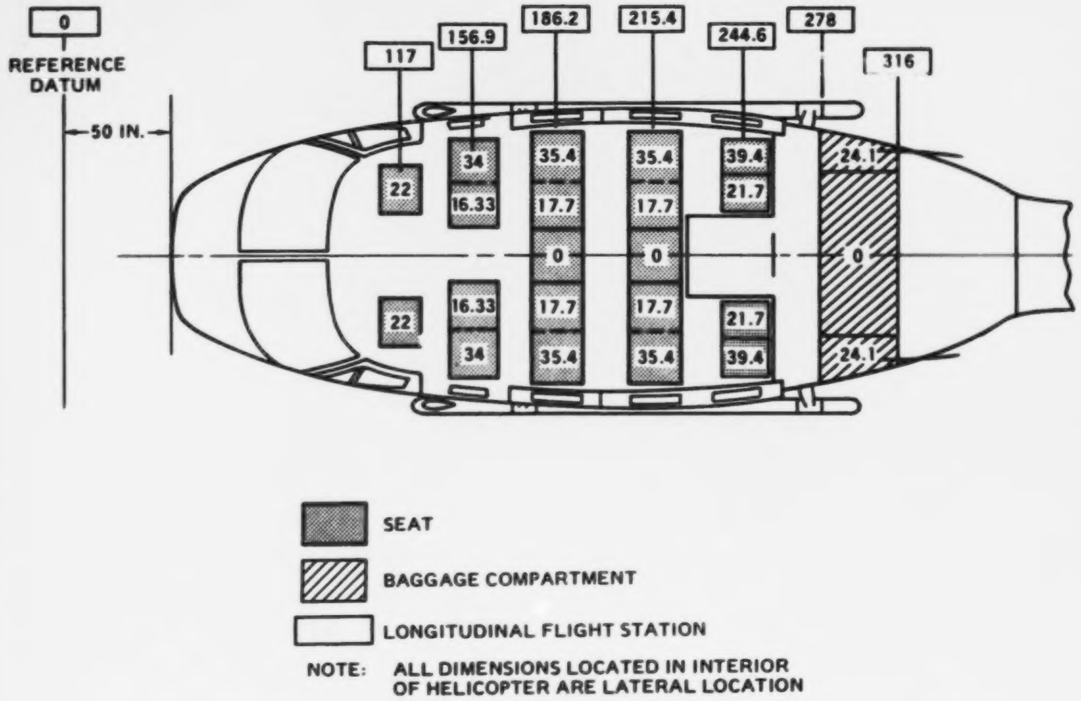
FIGURE 46.—Beech 1900 Loading Limitations.

| OPERATING CONDITIONS | BL-1 | BL-2 | BL-3 | BL-4 | BL-5 |
|---|---|---|---|---|---|
| CREW WEIGHT | 340 | 400 | 360 | 380 | 370 |
| PASSENGER WT | | | | | |
| ROW 1 | 700 | 620 | - | 180 | 680 |
| ROW 2 | 830 | 700 | 750 | 800 | 950 |
| ROW 3 | 800 | 680 | 810 | 720 | 850 |
| ROW 4 | - | 400 | 650 | 200 | 500 |
| BAGGAGE | | | | | |
| CENTER | 500 | 550 | 300 | 200 | 450 |
| LEFT AND RIGHT | 200 | 250 | - | 100 | - |
| FUEL | | | | | |
| GALLONS | 300 | 250 | 360 | 400 | 260 |
| TYPE | JET A | JET B | JET A | JET B | JET A |

FIGURE 47.—Bell 214 ST Loading.

| LOADING CONDITIONS | BL-6 | BL-7 | BL-8 | BL-9 | BL-10 |
|---|---|---|---|---|---|
| BASIC WEIGHT | 10,225 | 9,450 | 9,000 | 9,510 | 9,375 |
| BASIC MOM/100 | 25562.5 | 23236.0 | 22020.5 | 23499.9 | 23296.8 |
| CREW WEIGHT | 340 | 380 | 410 | 360 | 400 |
| PASSENGER WEIGHT | 3,280 | 2,880 | 3,150 | 2,040 | 2,400 |
| PASSENGER MOM/100 | 6722.5 | 5418.6 | 6425.8 | 4732.2 | 4560.7 |
| BAGGAGE (CENTER) | 700 | 600 | 300 | 550 | 650 |
| FUEL LOAD (6.8 LB/GAL) | 435 | 290 | 220 | 435 | 380 |
| TRIP FUEL BURN (GAL) | 355 | 190 | 190 | 325 | 330 |
| LATERAL CG IS ON LONGITUDINAL AXIS | | | | | |

FIGURE 48.—Bell 214 ST Weight Shift and Limits.


0
REFERENCE DATUM
50 IN.
117
156.9
186.2
215.4
244.6
278
316
22
34
16.33
35.4
17.7
0
39.4
21.7
24.1
22
16.33
34
17.7
35.4
21.7
39.4
24.1
SEAT
BAGGAGE COMPARTMENT
LONGITUDINAL FLIGHT STATION
NOTE: ALL DIMENSIONS LOCATED IN INTERIOR OF HELICOPTER ARE LATERAL LOCATION

Helicopter station diagram

| | WEIGHT | CG | MOMENT |
|---|---|---|---|
| WEIGHT EMPTY | 9387.5 | 247.89 | 2327105 |

FIGURE 49.—Helicopter - Loading Data.

## Crew and Passenger Table of Moments

| CREW AND PASSENGER TABLE OF MOMENTS (IN-LB) | | | | | |
|---|---|---|---|---|---|
| | CREW SEATS | AIRLINE PASSENGER SEATS | | | |
| WEIGHT LBS | F.S. 117 | FIRST ROW (FOUR PASSENGER) SEATS F.S.156.9 | SECOND ROW (FIVE PASSENGER) SEATS F.S. 186.2 | THIRD ROW (FIVE PASSENGER) SEATS F.S. 215.4 | FOURTH ROW (FOUR PASSENGER) SEATS F.S. 244.6 |
| 100 | 11700 | 15690 | 18620 | 21540 | 24460 |
| 110 | 12870 | 17259 | 20482 | 23694 | 26906 |
| 120 | 14040 | 18828 | 22344 | 25848 | 29352 |
| 130 | 15210 | 20397 | 24206 | 28002 | 31798 |
| 140 | 16380 | 21966 | 26068 | 30156 | 34244 |
| 150 | 17550 | 23535 | 27930 | 32310 | 36690 |
| 160 | 18720 | 25104 | 29792 | 34464 | 39136 |
| 170 | 19890 | 26673 | 31654 | 36618 | 41582 |
| 180 | 21060 | 28242 | 33516 | 38772 | 44028 |
| 190 | 22230 | 29811 | 35378 | 40926 | 46474 |
| 200 | 23400 | 31380 | 37240 | 43080 | 48920 |
| 210 | 24570 | 32949 | 39102 | 45234 | 51366 |
| 220 | 25740 | 34518 | 40964 | 47388 | 53812 |

## Baggage Compartment Loading Table

| BAGGAGE COMPARTMENT LOADING TABLE (IN. LB. ÷ 100) | | |
|---|---|---|
| BAGGAGE WEIGHT LBS | LEFT AND RIGHT BAGGAGE COMPARTMENT STA. 278.0 TO 316.0 F.S. 295.2 | CENTER BAGGAGE COMPARTMENT STA. 278.0 TO 316.0 F.S. 297.0 |
| 50 | 147.6 | 148.5 |
| 100 | 295.2 | 297.0 |
| 150 | 442.8 | 445.5 |
| 200 | 590.4 | 594.0 |
| 250 | 738.0 | 742.5 |
| 300 | 885.6 | 891.0 |
| 350 | 1033.2 | 1039.5 |
| 400 | 1180.8 | 1188.0 |
| 450 | 1328.4 | 1336.5 |
| 500 | 1476.0 | 1485.0 |
| 530 | 1564.6 | 1574.1 |
| 550 | | 1633.5 |
| 600 | | 1782.0 |
| 650 | | 1930.5 |
| 700 | | 2079.0 |
| 740 | | 2197.8 |

FIGURE 50.—Helicopter - Weights and Moments - Crew, Passengers, and Baggage.

## Usable Fuel Loading Table

### USABLE FUEL LOADING TABLE (ENGLISH)

JET A, JET A-1, JP-5 (6.8 LBS/GAL)

| U.S. GAL | WEIGHT LBS | C.G. | MOMENT IN. LB. ÷ 100 | U.S. GAL | WEIGHT LBS | C.G. | MOMENT IN. LB. ÷ 100 |
|---|---|---|---|---|---|---|---|
| 10 | 68 | 244.3 | 166 | 220 | 1496 | 246.9 | 3694 |
| 20 | 136 | 244.3 | 332 | 230 | 1564 | 244.3 | 3820 |
| 30 | 204 | 244.4 | 499 | 240 | 1632 | 241.8 | 3947 |
| **37.1 | 252 | 244.4 | 616 | 250 | 1700 | 239.6 | 4073 |
| 40 | 272 | 242.8 | 660 | 260 | 1768 | 237.6 | 4200 |
| 50 | 340 | 237.8 | 808 | 270 | 1836 | 235.6 | 4326 |
| 60 | 408 | 234.5 | 957 | 280 | 1904 | 233.9 | 4453 |
| 70 | 476 | 232.1 | 1105 | 290 | 1972 | 232.2 | 4579 |
| 80 | 544 | 230.9 | 1256 | **291.4 | 1982 | 232.0 | 4597 |
| 90 | 612 | 229.2 | 1403 | 300 | 2040 | 233.1 | 4754 |
| *99.7 | 678 | 228.2 | 1546 | 310 | 2108 | 234.0 | 4934 |
| *109.2 | 743 | 228.2 | 1695 | 320 | 2176 | 235.1 | 5115 |
| 110 | 748 | 228.5 | 1709 | 330 | 2244 | 236.0 | 5296 |
| 120 | 816 | 231.7 | 1890 | 340 | 2312 | 236.9 | 5477 |
| 130 | 884 | 234.4 | 2072 | 350 | 2380 | 237.7 | 5658 |
| 140 | 952 | 236.7 | 2253 | 360 | 2448 | 238.5 | 5839 |
| 150 | 1020 | 238.6 | 2434 | 370 | 2516 | 239.3 | 6021 |
| 160 | 1088 | 240.4 | 2615 | 380 | 2584 | 240.0 | 6202 |
| 170 | 1156 | 242.0 | 2798 | 390 | 2652 | 240.7 | 6383 |
| 180 | 1224 | 243.3 | 2978 | 400 | 2720 | 241.3 | 6564 |
| 190 | 1292 | 244.5 | 3159 | 410 | 2788 | 241.9 | 6745 |
| 200 | 1360 | 245.6 | 3340 | 420 | 2856 | 242.5 | 6927 |
| 210 | 1428 | 246.6 | 3521 | 430 | 2924 | 243.1 | 7108 |
| *218.4 | 1484 | 247.3 | 3673 | 435.0 | 2958 | 243.4 | 7199 |

JET B, JP-4 (6.5 LBS/GAL)

| U.S. GAL | WEIGHT LBS | C.G. | MOMENT IN. LB. ÷ 100 | U.S. GAL | WEIGHT LBS | C.G. | MOMENT IN. LB. ÷ 100 |
|---|---|---|---|---|---|---|---|
| 10 | 65 | 244.3 | 159 | 220 | 1430 | 246.9 | 3531 |
| 20 | 130 | 244.3 | 318 | 230 | 1495 | 244.3 | 3652 |
| 30 | 195 | 244.5 | 477 | 240 | 1560 | 241.8 | 3772 |
| **37.1 | 241 | 244.4 | 589 | 250 | 1625 | 239.6 | 3894 |
| 40 | 260 | 242.8 | 631 | 260 | 1690 | 237.6 | 4015 |
| 50 | 325 | 237.8 | 773 | 270 | 1755 | 235.6 | 4135 |
| 60 | 390 | 234.5 | 915 | 280 | 1820 | 233.9 | 4257 |
| 70 | 455 | 232.1 | 1056 | 290 | 1885 | 232.2 | 4377 |
| 80 | 520 | 230.9 | 1201 | **291.4 | 1894 | 232.0 | 4394 |
| 90 | 585 | 229.2 | 1341 | 300 | 1950 | 233.1 | 4545 |
| *99.7 | 648 | 228.2 | 1479 | 310 | 2015 | 234.0 | 4715 |
| *109.2 | 710 | 228.2 | 1620 | 320 | 2080 | 235.1 | 4890 |
| 110 | 715 | 228.5 | 1634 | 330 | 2145 | 236.0 | 5062 |
| 120 | 780 | 231.7 | 1807 | 340 | 2210 | 236.9 | 5235 |
| 130 | 845 | 234.4 | 1981 | 350 | 2275 | 237.7 | 5408 |
| 140 | 910 | 236.7 | 2154 | 360 | 2340 | 238.5 | 5581 |
| 150 | 975 | 238.6 | 2326 | 370 | 2405 | 239.3 | 5755 |
| 160 | 1040 | 240.4 | 2500 | 380 | 2470 | 240.5 | 5928 |
| 170 | 1105 | 242.0 | 2674 | 390 | 2535 | 240.7 | 6102 |
| 180 | 1170 | 243.3 | 2847 | 400 | 2600 | 241.3 | 6274 |
| 190 | 1235 | 244.5 | 3020 | 410 | 2665 | 241.9 | 6447 |
| 200 | 1300 | 245.6 | 3193 | 420 | 2730 | 242.5 | 6620 |
| 210 | 1365 | 246.6 | 3366 | 430 | 2795 | 243.1 | 6795 |
| *218.4 | 1420 | 247.3 | 3512 | 435 | 2827.5 | 243.4 | 6882 |

* Extreme limits of fuel C.G.
** Point of C.G. direction change.

Weights given are nominal weights at 15°C.

FIGURE 51.—Helicopter - Weights and Moments - Usable Fuel.

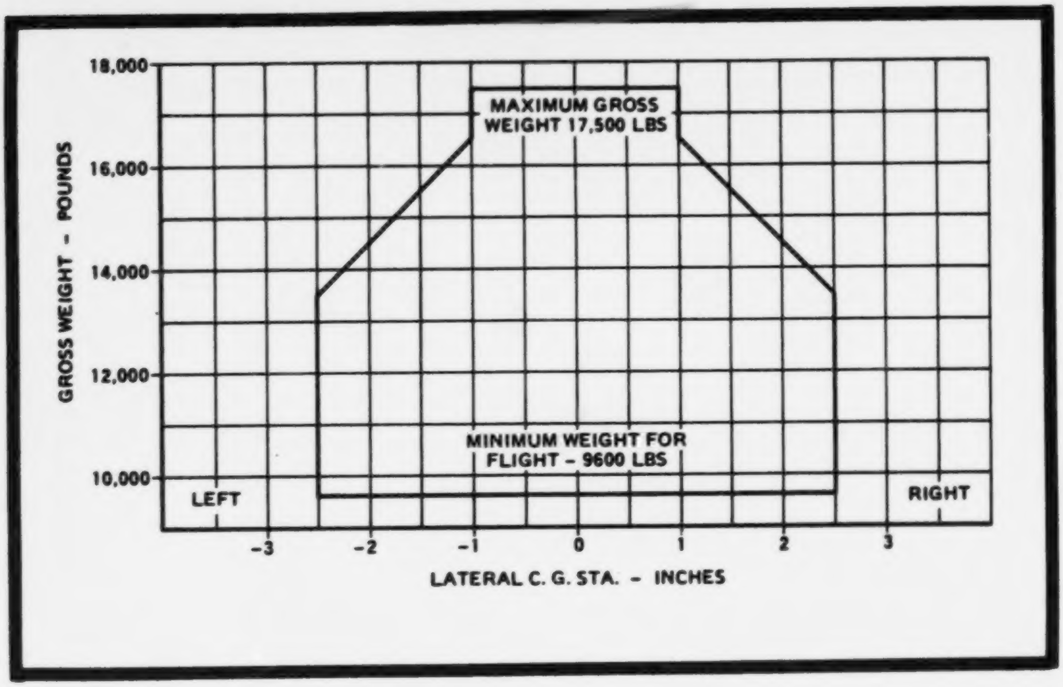


FIGURE 52.—Helicopter - Lateral CG Envelope.

240

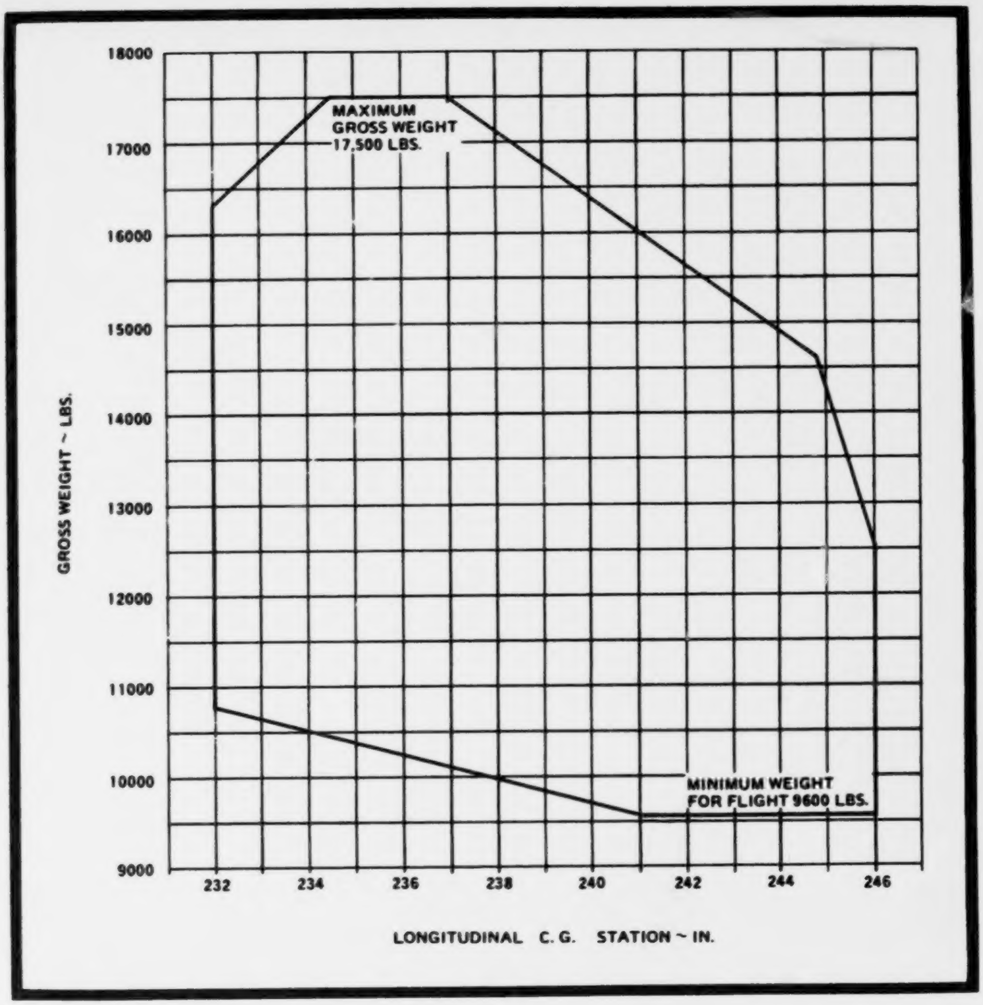
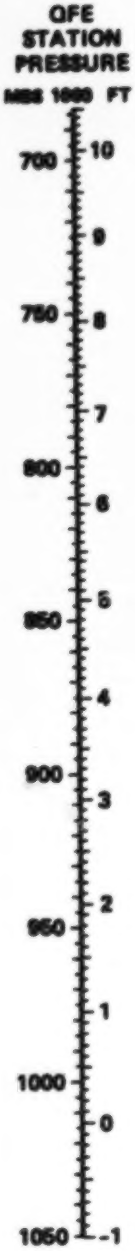


FIGURE 53.—Helicopter - Longitudinal CG Envelope.

## ALTIMETER SETTING TO STATION PRESSURE



### QNH TO PRESSURE ALTITUDE

| QNH IN. HG. | CORRECTION TO ELEVATION FOR PRESS. ALT FT | QNH MILLIBARS |
|---|---|---|
| 28.81 to 28.91 | 1000 | 976 to 979 |
| 28.91 to 29.02 | 900 | 979 to 983 |
| 29.02 to 29.12 | 800 | 983 to 986 |
| 29.12 to 29.23 | 700 | 986 to 990 |
| 29.23 to 29.34 | 600 | 990 to 994 |
| 29.34 to 29.44 | 500 | 994 to 997 |
| 29.44 to 29.55 | 400 | 997 to 1001 |
| 29.55 to 29.66 | 300 | 1001 to 1004 |
| 29.66 to 29.76 | 200 | 1004 to 1008 |
| 29.76 to 29.87 | 100 | 1008 to 1012 |
| 29.87 to 29.97 | 0 | 1012 to 1015 |
| 29.97 to 30.08 | −100 | 1015 to 1019 |
| 30.08 to 30.19 | −200 | 1019 to 1022 |
| 30.19 to 30.30 | −300 | 1022 to 1026 |
| 30.30 to 30.41 | −400 | 1026 to 1030 |
| 30.41 to 30.52 | −500 | 1030 to 1034 |
| 30.52 to 30.63 | −600 | 1034 to 1037 |
| 30.63 to 30.74 | −700 | 1037 to 1041 |
| 30.74 to 30.85 | −800 | 1041 to 1045 |
| 30.85 to 30.96 | −900 | 1045 to 1048 |
| 30.96 to 31.07 | −1000 | 1048 to 1052 |

EXAMPLE: ELEVATION = 2500FT
QNH = 29.48 IN.HG
CORRECTION = 400 FT.
PRESS ALT = 2900 FT

FIGURE 54.—Altimeter Setting to Pressure Altitude.

| OPERATING CONDITIONS | A-1 | A-2 | A-3 | A-4 | A-5 |
|---|---|---|---|---|---|
| FIELD ELEVATION | 2,500 | 600 | 4,200 | 5,100 | 2,100 |
| ALTIMETER SETTING | 29.40" | 30.50" | 1020 mb | 29.35" | 1035 mb |
| AMBIENT TEMPERATURE | +10° F | +80° F | 0° C | +30° F | +20° C |
| WEIGHT (X1000) | 75 | 85 | 90 | 80 | 65 |
| FLAP POSITION | 20° | 20° | 20° | 20° | 20° |
| RUNWAY SLOPE % | +1% | -1.5% | 0 | +1.5% | -2% |
| WIND COMPONENT | 10 HW | 10 TW | 15 HW | 5 TW | 20 HW |
| ICE PROTECTION | BOTH | NONE | BOTH | ENGINE | NONE |
| CG STATION | 590.2 | - | 580.3 | - | 594.4 |
| CG INDEX ARM | - | -3.1 | - | +5.9 | - |

INDEX ARM REF - STA 580.0, LEMAC - STA 549.13, AND -30.87 INDEX, MAC 141.5

CG % MAC = STAB TRIM SETTING

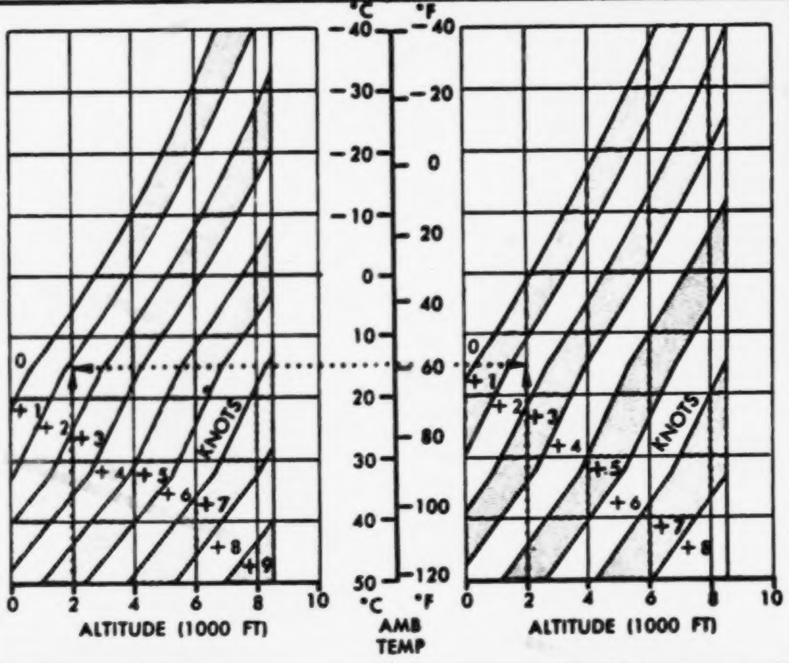
FIGURE 55.—DC-9 Takeoff.

# MODEL DC-9
# TAKEOFF SPEEDS
JT8D-1 ENGINES

## TAKEOFF SPEED — 20° FLAPS
EITHER NO ICE PROTECTION OR ENGINE ICE PROTECTION ONLY

| TAKEOFF WEIGHT (1000 LB) | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 |
|---|---|---|---|---|---|---|---|---|
| $V_1$ (KNOTS, IAS) | 104.0 | 110.0 | 115.0 | 120.5 | 125.0 | 129.5 | 133.5 | 136.0 |
| $V_R$ (KNOTS, IAS) | 106.5 | 112.5 | 118.0 | 123.5 | 129.0 | 134.0 | 139.0 | 143.5 |
| $V_2$ (KNOTS, IAS) | 117.0 | 121.5 | 126.5 | 130.5 | 135.0 | 139.0 | 143.0 | 147.0 |

## CORRECTION TO SPEEDS



| | | $V_1$ | $V_R$ | $V_2$ |
|---|---|---|---|---|
| AMBIENT TEMPERATURE AND AIRPORT PRESSURE ALTITUDE | | | | 0 |
| SLOPE PER 1% | UPHILL | + 1.5* KNOTS | +0.9 KNOTS | 0 |
| | DOWNHILL | -1.5 KNOTS | -0.9 KNOTS | |
| WIND PER 10 KN | HEADWIND | +0.30* KNOTS | 0 KNOTS | 0 |
| | TAILWIND | -0.8 KNOTS | | |
| ENGINE AND AIRPLANE ICE PROTECTION | | +0.8 KNOTS | +0.8 KNOTS | 0 |

* IF $V_1$ EXCEEDS $V_R$, SET $V_1$ EQUAL TO $V_R$

FIGURE 56.—Takeoff Speeds.

| OPERATING CONDITIONS | G-1 | G-2 | G-3 | G-4 | G-5 |
|---|---|---|---|---|---|
| FIELD ELEVATION FT | 1,050 | 2,000 | 4,350 | 3,050 | 2,150 |
| ALTIMETER SETTING | 29.36" | 1016 mb | 30.10" | 1010 mb | 29.54" |
| TEMPERATURE | +23° F | +10° C | +68° F | -5° C | +5° F |
| AIR COND ENGS 1 AND 3 | OFF | ON | ON | ON | ON |
| ANTI-ICE ENG 2 | ON | OFF | OFF | ON | ON |
| GROSS WEIGHT (X1000) | 140 | 190 | 180 | 160 | 120 |
| 6TH STAGE BLEED | OFF | ON | ON | OFF | OFF |
| FLAP POSITION | 15° | 5° | 25° | 15° | 5° |
| CG STATION | 911.2 | 882.2 | 914.8 | 932.9 | 925.6 |
| LEMAC - STA 860.5, MAC 180.9" | | | | | |

FIGURE 57.—B-727 Takeoff.

# TAKEOFF EPR, SPEEDS AND STAB TRIM SETTING

## MAX TAKEOFF EPR

0 - 60 KNOTS

ENG 1 & 3 AIRBLEED ON
ENG 2 NO AIRBLEED

| PRESS ALT FT | ENG | OAT °F<br>°C | -67 TO -9<br>-55 TO -21 | -4<br>-20 | 5<br>-15 | 14<br>-10 | 23<br>-5 | 32<br>0 | 41<br>5 | 50<br>10 | 59<br>15 | 68<br>20 | 77<br>25 | 86<br>30 | 95<br>35 | 104<br>40 | 113<br>45 | 120<br>49 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| -1000 | ENG | 1 & 3 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.04 | 2.03 | 1.99 | 1.94 | 1.91 |
| | | 2 | 2.06 | 2.06 | 2.06 | 2.06 | 2.06 | 2.06 | 2.06 | 2.06 | 2.06 | 2.06 | 2.06 | 2.06 | 2.05 | 2.00 | 1.96 | 1.92 |
| S.L. | | 1 & 3 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.08 | 2.03 | 1.99 | 1.94 | 1.91 |
| | | 2 | 2.11 | 2.11 | 2.11 | 2.11 | 2.11 | 2.11 | 2.11 | 2.11 | 2.11 | 2.11 | 2.11 | 2.10 | 2.05 | 2.00 | 1.96 | 1.92 |
| 1000 | | 1 & 3 | 2.15 | 2.15 | 2.15 | 2.15 | 2.15 | 2.15 | 2.15 | 2.13 | 2.12 | 2.12 | 2.11 | 2.08 | 2.03 | 1.99 | 1.94 | 1.91 |
| | | 2 | 2.16 | 2.16 | 2.16 | 2.16 | 2.16 | 2.16 | 2.16 | 2.15 | 2.13 | 2.13 | 2.12 | 2.10 | 2.05 | 2.00 | 1.96 | 1.92 |
| 2000 | | 1 & 3 | 2.21 | 2.21 | 2.21 | 2.21 | 2.21 | 2.20 | 2.17 | 2.14 | 2.14 | 2.14 | 2.11 | 2.08 | 2.03 | 1.99 | 1.94 | 1.91 |
| | | 2 | 2.22 | 2.22 | 2.22 | 2.22 | 2.22 | 2.21 | 2.18 | 2.16 | 2.16 | 2.15 | 2.12 | 2.10 | 2.05 | 2.00 | 1.96 | 1.92 |
| 3000 | | 1 & 3 | 2.26 | 2.26 | 2.26 | 2.25 | 2.23 | 2.20 | 2.17 | 2.14 | 2.14 | 2.14 | 2.11 | 2.08 | 2.03 | 1.99 | 1.94 | 1.91 |
| | | 2 | 2.28 | 2.28 | 2.28 | 2.27 | 2.24 | 2.21 | 2.18 | 2.16 | 2.16 | 2.15 | 2.12 | 2.10 | 2.05 | 2.00 | 1.96 | 1.92 |
| 3856 & ABOVE | | 1 & 3 | 2.31 | 2.29 | 2.27 | 2.25 | 2.23 | 2.20 | 2.17 | 2.14 | 2.14 | 2.14 | 2.11 | 2.08 | 2.03 | 1.99 | 1.94 | 1.91 |
| | | 2 | 2.32 | 2.31 | 2.29 | 2.27 | 2.24 | 2.21 | 2.18 | 2.16 | 2.16 | 2.15 | 2.12 | 2.10 | 2.05 | 2.00 | 1.96 | 1.92 |

| EPR BLEED CORRECTIONS | ENG 1 & 3 | ENG 2 |
|---|---|---|
| AIR CONDITIONING | OFF+.06 | - |
| ENGINE ANTI-ICE ON | - | -.03 |

REDUCE ENG 2 EPR BY .05 WITH 8TH STAGE BLEED ON (IF INSTALLED) FOR 10°C (50°F) OAT & WARMER

## $V_1$, $V_R$, $V_2$

ANTI-SKID OPERATIVE

| PRESSURE ALT - 1000 FT | | OAT | | | |
|---|---|---|---|---|---|
| 9 TO 11 | °F<br>°C | (ABOVE CERTIFIED ALTITUDE) | | -65 TO 25<br>-54 -4 | 26 TO 87<br>-3 31 |
| 7 TO 9 | °F<br>°C | | -65 TO 9<br>-54 -13 | 10 TO 75<br>-12 24 | 76 TO 104<br>25 40 |
| 5 TO 7 | °F<br>°C | -65 TO -10<br>-54 -23 | -8 TO 42<br>-22 5 | 43 TO 97<br>6 36 | 98 TO 111<br>37 44 |
| 3 TO 5 | °F<br>°C | -65 TO 32<br>-54 0 | 33 TO 90<br>1 32 | 91 TO 113<br>33 45 | 114 TO 120<br>46 49 |
| 1 TO 3 | °F<br>°C | -65 TO 83<br>-54 28 | 84 TO 106<br>29 41 | 107 TO 120<br>42 49 | |
| -1 TO 1 | °F<br>°C | -65 TO 99<br>-54 37 | 100 TO 120<br>38 49 | | |

| FLAPS | GROSS WEIGHT 1000 LB | $V_1=V_R$ | $V_2$ | $V_1=V_R$ | $V_2$ | $V_1=V_R$ | $V_2$ | $V_1=V_R$ | $V_2$ |
|---|---|---|---|---|---|---|---|---|---|
| 5 | 210 | 165 | 175 | 166 | 175 | | | | |
| | 200 | 160 | 171 | 162 | 171 | | | | |
| | 190 | 155 | 167 | 157 | 167 | 158 | 167 | | |
| | 180 | 150 | 163 | 152 | 163 | 154 | 163 | | |
| | 170 | 144 | 159 | 147 | 159 | 149 | 159 | 150 | 158 |
| | 160 | 140 | 154 | 141 | 153 | 143 | 153 | 145 | 153 |
| | 150 | 135 | 149 | 136 | 149 | 138 | 149 | 140 | 148 |
| | 140 | 129 | 145 | 130 | 145 | 132 | 144 | 134 | 144 |
| | 130 | 124 | 140 | 125 | 139 | 126 | 138 | 128 | 138 |
| | 120 | 119 | 135 | 120 | 134 | 120 | 134 | 121 | 133 |
| 15 | 210 | 156 | 166 | 157 | 166 | | | | |
| | 200 | 151 | 162 | 153 | 162 | | | | |
| | 190 | 146 | 158 | 148 | 158 | 149 | 158 | | |
| | 180 | 141 | 154 | 143 | 154 | 145 | 154 | | |
| | 170 | 136 | 150 | 138 | 150 | 140 | 150 | 141 | 149 |
| | 160 | 132 | 146 | 133 | 145 | 135 | 145 | 137 | 145 |
| | 150 | 127 | 141 | 128 | 141 | 130 | 141 | 132 | 140 |
| | 140 | 122 | 137 | 123 | 137 | 124 | 136 | 126 | 136 |
| | 130 | 117 | 133 | 118 | 132 | 118 | 131 | 120 | 131 |
| | 120 | 112 | 128 | 113 | 127 | 113 | 127 | 115 | 126 |
| 20 | 210 | 151 | 161 | 152 | 161 | | | | |
| | 200 | 146 | 157 | 148 | 157 | | | | |
| | 190 | 141 | 153 | 143 | 153 | 144 | 153 | | |
| | 180 | 136 | 150 | 138 | 150 | 140 | 149 | | |
| | 170 | 132 | 146 | 133 | 146 | 135 | 145 | 136 | 145 |
| | 160 | 128 | 142 | 129 | 141 | 131 | 141 | 133 | 141 |
| | 150 | 123 | 137 | 124 | 137 | 126 | 136 | 128 | 136 |
| | 140 | 118 | 133 | 119 | 133 | 120 | 132 | 122 | 132 |
| | 130 | 113 | 129 | 114 | 128 | 114 | 127 | 116 | 127 |
| | 120 | 109 | 124 | 109 | 123 | 109 | 123 | 111 | 122 |
| 25 | 210 | 146 | 157 | 147 | 157 | | | | |
| | 200 | 141 | 153 | 143 | 153 | | | | |
| | 190 | 137 | 149 | 138 | 149 | 139 | 149 | | |
| | 180 | 132 | 145 | 134 | 145 | 136 | 145 | | |
| | 170 | 127 | 141 | 129 | 141 | 131 | 141 | 132 | 140 |
| | 160 | 123 | 137 | 124 | 137 | 126 | 137 | 128 | 136 |
| | 150 | 119 | 133 | 120 | 133 | 122 | 133 | 124 | 132 |
| | 140 | 114 | 129 | 115 | 129 | 116 | 128 | 118 | 128 |
| | 130 | 109 | 125 | 110 | 124 | 110 | 124 | 112 | 123 |
| | 120 | 105 | 120 | 106 | 120 | 106 | 119 | 108 | 118 |

## STAB TRIM SETTING

| CG% | FLAPS | | |
|---|---|---|---|
| | 5 | 15 /20 | 25 |
| | UNITS AIRPLANE NOSE UP | | |
| 10 | 6 3/4 | 7 1/2 | 8 1/4 |
| 12 | 6 1/2 | 7 1/4 | 8 |
| 14 | 6 1/4 | 7 | 7 3/4 |
| 16 | 6 | 6 3/4 | 7 1/2 |
| 18 | 5 3/4 | 6 1/2 | 7 |
| 20 | 5 1/2 | 6 | 6 1/2 |
| 22 | 5 | 5 3/4 | 6 1/4 |
| 24 | 4 3/4 | 5 1/4 | 5 3/4 |
| 26 | 4 1/2 | 4 3/4 | 5 1/4 |
| 28 | 4 | 4 1/2 | 4 3/4 |
| 30 | 3 3/4 | 4 | 4 1/4 |
| 32 | 3 1/2 | 3 3/4 | 4 |
| 34 | 3 1/4 | 3 1/4 | 3 1/2 |
| 36 | 2 3/4 | 3 | 3 |
| 38 | 2 1/2 | 2 1/2 | 2 1/2 |
| 40 | 2 1/2 | 2 1/2 | 2 1/2 |
| 42 | 2 1/2 | 2 1/2 | 2 1/2 |

## FLAP RETRACTION/ MANEUVERING SPEEDS

| GROSS WEIGHT LB | FLAP POSITION | | | |
|---|---|---|---|---|
| | 15 | 5 | 2 | 0 |
| 154500 & BELOW | 150 | 160 | 190 | 200 |
| 154501 TO 176000 | 160 | 170 | 200 | 210 |
| 176001 TO 191000 | 170 | 180 | 210 | 220 |
| ABOVE 191000 | 180 | 190 | 225 | 235 |

FOR MANEUVERS IMMEDIATELY AFTER TAKEOFF EXCEEDING 15° BANK MAINTAIN AT LEAST $V_2$+10 AT TAKEOFF FLAPS

FIGURE 58.—Takeoff Performance.

| OPERATING CONDITIONS | R-1 | R-2 | R-3 | R-4 | R-5 |
|---|---|---|---|---|---|
| FIELD ELEVATION | 100 | 4,000 | 950 | 2,000 | 50 |
| ALTIMETER SETTING | 29.50" | 1032 mb | 29.40" | 1017 mb | 30.15" |
| TEMPERATURE (OAT) | +50° F | -15° C | +59° F | 0° C | +95° F |
| WEIGHT (X1000) | 90 | 110 | 100 | 85 | 95 |
| FLAP POSITION | 15° | 5° | 5° | 1° | 1° |
| WIND COMPONENT (KTS) | 5 HW | 5 TW | 20 HW | 10 TW | 7 HW |
| RUNWAY SLOPE % | 1% UP | 1% DN | 1% UP | 2% DN | 1.5% UP |
| AIR CONDITIONING | ON | ON | OFF | ON | OFF |
| ENGINE ANTI-ICE | OFF | ON | OFF | ON | OFF |
| CG STATION | 635.7 | 643.8 | 665.2 | 657.2 | 638.4 |
| LEMAC STA 625.0, MAC 134.0 | | | | | |

FIGURE 59.—B-737 Takeoff.

| OPERATING CONDITIONS | V-1 | V-2 | V-3 | V-4 | V-5 |
|---|---|---|---|---|---|
| BRK REL WEIGHT (X1000) | 110 | 95 | 85 | 105 | 75 |
| CRUISE PRESS ALT | 33,000 | 27,000 | 35,000 | 22,000 | 31,000 |
| AIRPORT ELEVATION | 2,000 | 3,000 | 2,000 | 4,000 | 2,000 |
| ISA TEMPERATURE | +10° | ISA | ISA | +10° | +10° |
| AVG WIND COMP (KTS) | 20 HW | 20 TW | 30 HW | 10 TW | 40 HW |

FIGURE 60.—B-737 En Route Climb.

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0 TO 60 KTS

**TAKEOFF EPR** A/C ON

| EPR BLEED CORRECTIONS | △ EPR |
|---|---|
| AIR CONDITIONING OFF | +.03 |
| ENGINE ANTI-ICE | ZERO |

| OAT | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| °F | -65 | -49 | -40 | -31 | -22 | -13 | - 4 | 5 | 14 | 23 | 32 | 41 | 50 | 59 | 68 | 77 | 86 | 95 | 104 | 120 |
| °C | -54 | -45 | -40 | -35 | -30 | -25 | -20 | -15 | -10 | - 5 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 49 |
| TEMP LIMIT EPR | 2.31 | 2.31 | 2.31 | 2.29 | 2.27 | 2.24 | 2.22 | 2.19 | 2.17 | 2.14 | 2.11 | 2.07 | 2.04 | 2.01 | 2.01 | 2.01 | 2.00 | 1.95 | 1.91 | 1.82 |

| PRESS | | | | | | | |
|---|---|---|---|---|---|---|---|
| EPR | 2.31 | 2.22 | 2.16 | 2.11 | 2.06 | 2.01 | 1.96 |
| ALT | 5660 AND ABOVE | 4000 | 3000 | 2000 | 1000 | S.L. | -1000 |

① FIND TEMP LIMIT EPR
② FIND PRESS LIMIT EPR
③ USE THE SMALLER OF THE TWO LIMITS

## V1, VR, V2

ANTI-SKID ON

| PRESSURE ALTITUDE 1000 FT | | OAT | | | | | |
|---|---|---|---|---|---|---|---|
| 9 to 10 | F°<br>C° | | | -65 to -19<br>-54 to -28 | -18 to 18<br>-27 to - 8 | 19 to 45<br>- 7 to 7 | 46 to 86<br>8 to 30 |
| 7 to 9 | F°<br>C° | | -65 to -21<br>-54 to -29 | -20 to 10<br>-28 to -23 | 11 to 39<br>-22 to 4 | 40 to 87<br>5 to 31 | 88 to 101<br>32 to 38 |
| 5 to 7 | F°<br>C° | -65 to -15<br>-54 to -26 | -14 to 15<br>-27 to - 9 | 16 to 40<br>- 8 to 4 | 41 to 87<br>5 to 31 | 88 to 105<br>32 to 40 | 106 to 109<br>41 to 43 |
| 3 to 5 | F°<br>C° | -65 to 20<br>-54 to - 8 | 21 to 42<br>-7 to 6 | 43 to 88<br>7 to 31 | 89 to 103<br>32 to 39 | 104 to 116<br>40 to 46 | |
| 1 to 3 | F°<br>C° | -65 to 46<br>-54 to 8 | 47 to 89<br>9 to 32 | 90 to 104<br>33 to 40 | 105 to 120<br>41 to 49 | | |
| -1 to 1 | F°<br>C° | -65 to 91<br>-54 to 33 | 92 to 105<br>34 to 40 | 106 to 120<br>41 to 49 | | | |

| FLAPS | GROSS WT -1000 LB | $V_1$ | $V_R$ | $V_2$ | $V_1$ | $V_R$ | $V_2$ | $V_1$ | $V_R$ | $V_2$ | $V_1$ | $V_R$ | $V_2$ | $V_1$ | $V_R$ | $V_2$ | $V_1$ | $V_R$ | $V_2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 120 | 159 | 161 | 164 | 160 | 162 | 164 | | | | | | | | | | | | |
| | 110 | 150 | 152 | 155 | 151 | 153 | 155 | 152 | 154 | 155 | | | | | | | | | |
| | 100 | 141 | 143 | 147 | 142 | 143 | 147 | 142 | 144 | 147 | 143 | 145 | 147 | 144 | 146 | 147 | | | |
| | 90 | 131 | 133 | 138 | 132 | 134 | 138 | 133 | 135 | 138 | 133 | 136 | 138 | 134 | 136 | 138 | 135 | 137 | 138 |
| | 80 | 122 | 124 | 130 | 122 | 125 | 130 | 123 | 126 | 130 | 124 | 126 | 130 | 125 | 127 | 130 | 125 | 128 | 130 |
| | 70 | 112 | 116 | 123 | 113 | 117 | 123 | 113 | 117 | 122 | 114 | 118 | 122 | 115 | 119 | 122 | 116 | 119 | 122 |
| 5 | 120 | 153 | 155 | 158 | 154 | 156 | 158 | | | | | | | | | | | | |
| | 110 | 144 | 146 | 150 | 145 | 147 | 150 | | | | | | | | | | | | |
| | 100 | 135 | 137 | 142 | 136 | 138 | 142 | 137 | 139 | 142 | 138 | 140 | 142 | | | | | | |
| | 90 | 126 | 128 | 133 | 127 | 129 | 133 | 128 | 130 | 133 | 129 | 131 | 133 | 130 | 132 | 133 | | | |
| | 80 | 116 | 118 | 125 | 117 | 119 | 125 | 118 | 121 | 125 | 119 | 122 | 125 | 120 | 123 | 125 | 121 | 124 | 125 |
| | 70 | 106 | 109 | 118 | 107 | 110 | 118 | 108 | 111 | 117 | 109 | 112 | 117 | 110 | 113 | 117 | 112 | 114 | 117 |
| 15 | 100 | 130 | 130 | 135 | 131 | 131 | 135 | 132 | 132 | 135 | | | | | | | | | |
| | 90 | 120 | 121 | 128 | 121 | 122 | 128 | 123 | 123 | 128 | 124 | 124 | 128 | 125 | 125 | 128 | 126 | 126 | 128 |
| | 80 | 111 | 112 | 119 | 112 | 113 | 119 | 113 | 114 | 119 | 114 | 115 | 119 | 115 | 116 | 119 | 117 | 117 | 119 |
| | 70 | 106 | 108 | 112 | 101 | 103 | 112 | 102 | 105 | 112 | 103 | 106 | 112 | 105 | 107 | 112 | 106 | 108 | 112 |
| 25 | 100 | 124 | 126 | 132 | 126 | 127 | 132 | | | | | | | | | | | | |
| | 90 | 115 | 117 | 124 | 116 | 118 | 124 | 117 | 119 | 124 | 118 | 120 | 124 | | | | | | |
| | 80 | 105 | 108 | 116 | 107 | 109 | 116 | 108 | 110 | 116 | 109 | 111 | 116 | 110 | 112 | 116 | 111 | 113 | 116 |
| | 70 | 106 | 106 | 108 | 104 | 104 | 108 | 101 | 101 | 108 | 99 | 102 | 108 | 100 | 103 | 108 | 101 | 104 | 108 |

SHADED AREA INDICATES PERFORMANCE AFFECTED BY MINIMUM CONTROL SPEED, MINIMUM FIELD LENGTH FOR LIGHTEST WEIGHT ABOVE SHADED AREA IS REQUIRED.

## FLAP RETRACTION/ MANEUVERING SPEED

| FLAP POS | KTS IAS |
|---|---|
| 0 | 210 |
| 1 | 190 |
| 2 | 180 |
| 5 | 170 |
| 10 | 160 |
| 15 | 150 |
| 25 | 140 |

FOR MANEUVERS IMMEDIATELY AFTER TAKE-OFF EXCEEDING 15° BANK, MAINTAIN AT LEAST V2 + 15 AT TAKE-OFF FLAPS

**STAB. TRIM SETTING**
- UNITS AIRPLANE NOSE UP

| CG | FLAPS ALL |
|---|---|
| 6 | 8 |
| 8 | 7-3/4 |
| 10 | 7-1/2 |
| 12 | 7 |
| 14 | 6-3/4 |
| 16 | 6-1/4 |
| 18 | 5-3/4 |
| 20 | 5-1/2 |
| 22 | 5 |
| 24 | 4-1/2 |
| 26 | 4 |
| 28 | 3-1/2 |
| 30 | 3 |
| 32 | 2-1/2 |

SPEEDS NOT VALID WHEN WEIGHTS ARE PREDICATED ON USE OF CLEARWAY, STOPWAY, IMPROVED CLIMB OR ARE LIMITED BY BRAKE ENERGY

$V_1$ ADJUSTMENTS*

| WIND | SLOPE |
|---|---|
| ADD 1 KT PER 20 KTS HEADWIND | ADD 1 KT PER 1% UP SLOPE |
| SUBSTRACT 1 KT PER 5 KTS TAILWIND | SUBTRACT 1 KT PER 1% DOWN SLOPE |

*$V_1$ MUST NOT EXCEED $V_R$

FIGURE 61.—Takeoff Performance.

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## ENROUTE CLIMB 280/.70 ISA

| PRESSURE ALTITUDE -FT | UNITS MIN/LB NM/KNOTS | BRAKE RELEASE WEIGHT - LB | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 120000 | 115000 | 110000 | 105000 | 100000 | 95000 | 90000 | 85000 | 80000 | 75000 | 65000 |
| 37000 | TIME/FUEL<br>DIST./TAS | | 41/ 5700<br>251/387 | 32/ 4700<br>192/384 | 27/ 4100<br>162/382 | 24/ 3700<br>140/380 | 21/ 3400<br>124/379 | 19/ 3100<br>111/378 | 17/ 2800<br>100/377 | 16/ 2500<br>90/376 | 14/ 2300<br>82/375 | 12/ 1900<br>67/374 |
| 36000 | TIME/FUEL<br>DIST./TAS | 41/ 5900<br>246/386 | 33/ 4900<br>194/383 | 28/ 4300<br>164/381 | 25/ 3900<br>143/379 | 22/ 3500<br>127/378 | 20/ 3200<br>114/377 | 18/ 2900<br>103/376 | 16/ 2700<br>93/375 | 15/ 2500<br>84/374 | 14/ 2300<br>77/374 | 11/ 1900<br>63/373 |
| 35000 | TIME/FUEL<br>DIST./TAS | 33/ 5100<br>197/382 | 29/ 4500<br>168/380 | 25/ 4100<br>147/378 | 23/ 3700<br>131/377 | 21/ 3400<br>117/376 | 19/ 3100<br>106/375 | 17/ 2800<br>96/374 | 16/ 2600<br>87/373 | 14/ 2400<br>80/373 | 13/ 2200<br>73/372 | 11/ 1800<br>60/371 |
| 34000 | TIME/FUEL<br>DIST./TAS | 29/ 4700<br>171/379 | 26/ 4300<br>150/377 | 23/ 3900<br>134/376 | 21/ 3500<br>120/375 | 19/ 3200<br>109/374 | 18/ 3000<br>99/373 | 16/ 2700<br>90/372 | 15/ 2500<br>82/372 | 14/ 2300<br>75/371 | 12/ 2100<br>69/371 | 10/ 1800<br>57/370 |
| 33000 | TIME/FUEL<br>DIST./TAS | 27/ 4400<br>153/376 | 24/ 4000<br>137/375 | 22/ 3700<br>123/374 | 20/ 3400<br>112/373 | 18/ 3100<br>102/372 | 17/ 2900<br>93/371 | 15/ 2700<br>85/370 | 14/ 2500<br>78/370 | 13/ 2300<br>71/369 | 12/ 2100<br>65/369 | 10/ 1700<br>56/368 |
| 32000 | TIME/FUEL<br>DIST./TAS | 25/ 4200<br>139/374 | 23/ 3900<br>126/372 | 21/ 3600<br>114/371 | 19/ 3300<br>104/370 | 17/ 3000<br>95/370 | 16/ 2800<br>87/369 | 15/ 2600<br>80/368 | 14/ 2400<br>74/368 | 12/ 2200<br>67/367 | 11/ 2000<br>62/367 | 10/ 1700<br>51/366 |
| 31000 | TIME/FUEL<br>DIST./TAS | 23/ 4000<br>128/371 | 21/ 3700<br>117/370 | 19/ 3400<br>107/369 | 18/ 3200<br>98/368 | 16/ 2900<br>90/367 | 15/ 2700<br>82/367 | 14/ 2500<br>76/366 | 13/ 2300<br>70/366 | 12/ 2100<br>64/365 | 11/ 2000<br>59/365 | 9/ 1700<br>49/364 |
| 30000 | TIME/FUEL<br>DIST./TAS | 22/ 3900<br>119/368 | 20/ 3600<br>109/367 | 18/ 3300<br>100/366 | 17/ 3100<br>92/365 | 16/ 2800<br>84/365 | 15/ 2600<br>78/364 | 13/ 2400<br>72/364 | 12/ 2300<br>66/363 | 11/ 2100<br>61/363 | 11/ 1900<br>56/363 | 9/ 1600<br>47/362 |
| 29000 | TIME/FUEL<br>DIST./TAS | 21/ 3700<br>111/365 | 19/ 3400<br>102/364 | 18/ 3200<br>93/363 | 16/ 3000<br>86/363 | 15/ 2700<br>79/362 | 14/ 2500<br>73/362 | 13/ 2400<br>68/361 | 12/ 2200<br>62/361 | 11/ 2000<br>57/361 | 10/ 1900<br>53/360 | 9/ 1600<br>44/360 |
| 28000 | TIME/FUEL<br>DIST./TAS | 19/ 3600<br>103/362 | 18/ 3300<br>95/361 | 17/ 3100<br>88/360 | 15/ 2900<br>81/360 | 14/ 2700<br>75/359 | 13/ 2500<br>69/359 | 12/ 2300<br>64/359 | 11/ 2100<br>59/358 | 11/ 2000<br>54/358 | 10/ 1800<br>50/358 | 8/ 1500<br>42/357 |
| 27000 | TIME/FUEL<br>DIST./TAS | 19/ 3400<br>96/358 | 17/ 3200<br>89/358 | 16/ 3000<br>82/357 | 15/ 2800<br>76/357 | 14/ 2600<br>71/356 | 13/ 2400<br>65/356 | 12/ 2200<br>60/356 | 11/ 2100<br>56/356 | 10/ 1900<br>52/355 | 9/ 1800<br>47/355 | 8/ 1500<br>40/355 |
| 26000 | TIME/FUEL<br>DIST./TAS | 17/ 3300<br>88/354 | 16/ 3000<br>82/354 | 15/ 2800<br>76/353 | 14/ 2600<br>70/353 | 13/ 2500<br>65/352 | 12/ 2300<br>60/352 | 11/ 2100<br>56/352 | 10/ 2000<br>52/352 | 10/ 1800<br>48/351 | 9/ 1700<br>44/351 | 7/ 1400<br>37/351 |
| 25000 | TIME/FUEL<br>DIST./TAS | 16/ 3100<br>81/350 | 15/ 2900<br>75/350 | 14/ 2700<br>70/349 | 13/ 2500<br>65/349 | 12/ 2400<br>60/349 | 11/ 2200<br>56/348 | 11/ 2000<br>52/348 | 10/ 1900<br>48/348 | 9/ 1800<br>45/348 | 8/ 1600<br>41/348 | 7/ 1400<br>35/347 |
| 24000 | TIME/FUEL<br>DIST./TAS | 15/ 3000<br>75/346 | 14/ 2800<br>69/346 | 13/ 2600<br>65/345 | 12/ 2400<br>60/345 | 12/ 2300<br>56/345 | 11/ 2100<br>52/345 | 10/ 2000<br>48/345 | 9/ 1800<br>45/344 | 9/ 1700<br>41/344 | 8/ 1600<br>38/344 | 7/ 1300<br>32/344 |
| 23000 | TIME/FUEL<br>DIST./TAS | 14/ 2800<br>69/342 | 13/ 2700<br>64/342 | 13/ 2500<br>60/342 | 12/ 2300<br>56/342 | 11/ 2200<br>52/342 | 10/ 2000<br>48/341 | 9/ 1900<br>45/341 | 9/ 1800<br>41/341 | 8/ 1600<br>38/341 | 8/ 1500<br>35/341 | 6/ 1300<br>30/341 |
| 22000 | TIME/FUEL<br>DIST./TAS | 14/ 2700<br>63/339 | 13/ 2500<br>59/339 | 12/ 2400<br>55/338 | 11/ 2200<br>51/338 | 10/ 2100<br>48/338 | 10/ 1900<br>45/338 | 9/ 1800<br>41/338 | 8/ 1700<br>38/338 | 8/ 1600<br>36/338 | 7/ 1400<br>33/338 | 6/ 1200<br>28/337 |
| 21000 | TIME/FUEL<br>DIST./TAS | 13/ 2600<br>58/335 | 12/ 2400<br>54/335 | 11/ 2300<br>51/335 | 10/ 2100<br>47/335 | 10/ 2000<br>44/335 | 9/ 1900<br>41/335 | 9/ 1700<br>38/335 | 8/ 1600<br>36/335 | 7/ 1500<br>33/334 | 7/ 1400<br>30/334 | 6/ 1200<br>26/334 |
| 20000 | TIME/FUEL<br>DIST./TAS | 12/ 2500<br>54/332 | 11/ 2300<br>50/332 | 11/ 2200<br>47/332 | 10/ 2000<br>44/332 | 9/ 1900<br>41/332 | 9/ 1800<br>38/332 | 8/ 1700<br>35/332 | 7/ 1500<br>33/331 | 7/ 1400<br>30/331 | 6/ 1300<br>28/331 | 5/ 1100<br>24/331 |
| 19000 | TIME/FUEL<br>DIST./TAS | 11/ 2400<br>49/329 | 11/ 2200<br>46/329 | 10/ 2100<br>43/329 | 9/ 1900<br>40/329 | 9/ 1800<br>37/329 | 8/ 1700<br>35/329 | 8/ 1600<br>33/328 | 7/ 1500<br>30/328 | 7/ 1400<br>28/328 | 6/ 1300<br>26/328 | 5/ 1100<br>22/328 |
| 18000 | TIME/FUEL<br>DIST./TAS | 11/ 2200<br>45/326 | 10/ 2100<br>42/326 | 9/ 2000<br>39/326 | 9/ 1900<br>37/326 | 8/ 1700<br>34/326 | 8/ 1600<br>32/326 | 7/ 1500<br>30/326 | 7/ 1400<br>28/325 | 6/ 1300<br>26/325 | 6/ 1200<br>24/325 | 5/ 1000<br>20/325 |
| 17000 | TIME/FUEL<br>DIST./TAS | 10/ 2100<br>41/323 | 9/ 2000<br>38/323 | 9/ 1900<br>36/323 | 8/ 1800<br>34/323 | 8/ 1700<br>32/323 | 7/ 1500<br>29/323 | 7/ 1400<br>27/323 | 6/ 1300<br>26/323 | 6/ 1200<br>24/323 | 5/ 1200<br>22/323 | 5/ 1000<br>19/322 |
| 16000 | TIME/FUEL<br>DIST./TAS | 9/ 2000<br>37/320 | 9/ 1900<br>35/320 | 8/ 1800<br>33/320 | 8/ 1700<br>31/320 | 7/ 1600<br>29/320 | 7/ 1500<br>27/320 | 6/ 1400<br>25/320 | 6/ 1300<br>23/320 | 5/ 1200<br>22/320 | 5/ 1100<br>20/320 | 4/ 900<br>17/320 |
| 15000 | TIME/FUEL<br>DIST./TAS | 9/ 1900<br>34/318 | 8/ 1800<br>32/317 | 8/ 1700<br>30/317 | 7/ 1600<br>28/317 | 7/ 1500<br>26/317 | 6/ 1400<br>24/317 | 6/ 1300<br>23/317 | 6/ 1200<br>21/317 | 5/ 1100<br>20/317 | 5/ 1000<br>18/317 | 4/ 900<br>15/317 |
| 14000 | TIME/FUEL<br>DIST./TAS | 8/ 1800<br>31/315 | 8/ 1700<br>29/315 | 7/ 1600<br>27/315 | 7/ 1500<br>25/315 | 6/ 1400<br>24/315 | 6/ 1300<br>22/315 | 6/ 1200<br>21/315 | 5/ 1100<br>19/315 | 5/ 1100<br>18/314 | 4/ 1000<br>17/314 | 4/ 800<br>14/314 |
| 13000 | TIME/FUEL<br>DIST./TAS | 8/ 1700<br>27/312 | 7/ 1600<br>26/312 | 7/ 1500<br>24/312 | 6/ 1400<br>23/312 | 6/ 1300<br>21/312 | 6/ 1200<br>20/312 | 5/ 1200<br>19/312 | 5/ 1100<br>17/312 | 5/ 1000<br>16/312 | 4/ 900<br>15/312 | 4/ 800<br>13/312 |
| 12000 | TIME/FUEL<br>DIST./TAS | 7/ 1600<br>24/310 | 7/ 1500<br>23/310 | 6/ 1400<br>22/310 | 6/ 1300<br>20/310 | 6/ 1300<br>19/309 | 5/ 1200<br>18/309 | 5/ 1100<br>17/309 | 5/ 1000<br>15/309 | 4/ 1000<br>14/309 | 4/ 900<br>13/309 | 3/ 800<br>11/309 |
| 11000 | TIME/FUEL<br>DIST./TAS | 7/ 1500<br>22/307 | 6/ 1400<br>20/307 | 6/ 1300<br>19/307 | 5/ 1300<br>18/307 | 5/ 1200<br>17/307 | 5/ 1100<br>16/307 | 5/ 1000<br>15/307 | 4/ 1000<br>14/307 | 4/ 900<br>13/307 | 4/ 800<br>12/307 | 3/ 700<br>10/307 |
| 10000 | TIME/FUEL<br>DIST./TAS | 6/ 1400<br>19/305 | 6/ 1300<br>18/305 | 5/ 1200<br>17/305 | 5/ 1200<br>16/305 | 5/ 1100<br>15/305 | 4/ 1000<br>14/305 | 4/ 1000<br>13/305 | 4/ 900<br>12/305 | 4/ 800<br>11/304 | 3/ 800<br>10/304 | 3/ 700<br>9/304 |
| 8000 | TIME/FUEL<br>DIST./TAS | 5/ 1200<br>14/300 | 5/ 1100<br>13/300 | 5/ 1100<br>12/300 | 4/ 1000<br>11/300 | 4/ 900<br>11/300 | 4/ 900<br>10/300 | 4/ 800<br>9/300 | 3/ 800<br>9/300 | 3/ 700<br>8/300 | 3/ 700<br>8/300 | 2/ 600<br>6/300 |
| 6000 | TIME/FUEL<br>DIST./TAS | 4/ 1000<br>9/295 | 4/ 1000<br>9/295 | 4/ 900<br>8/295 | 4/ 800<br>8/295 | 3/ 800<br>7/295 | 3/ 700<br>7/295 | 3/ 700<br>6/295 | 3/ 700<br>6/295 | 3/ 600<br>5/295 | 2/ 600<br>5/295 | 2/ 500<br>4/295 |
| 1500 | TIME/FUEL | 2/ 600 | 2/ 600 | 2/ 500 | 2/ 500 | 2/ 500 | 2/ 400 | 2/ 400 | 2/ 400 | 1/ 400 | 1/ 300 | 1/ 300 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| FUEL ADJUSTMENT FOR HIGH ELEVATION AIRPORTS | AIRPORT ELEVATION | 2000 | 4000 | 6000 | 8000 | 10000 | 12000 |
| EFFECT ON TIME AND DISTANCE IS NEGLIGIBLE | FUEL ADJUSTMENT | -100 | -200 | -400 | -500 | -600 | -700 |

FIGURE 62.—En Route Climb 280/.70 ISA.

## ENROUTE CLIMB 280/.70 ISA+10° C

| PRESSURE ALTITUDE -FT | UNITS MIN/LB NM/KNOTS | BRAKE RELEASE WEIGHT - LB | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 120000 | 115000 | 110000 | 105000 | 100000 | 95000 | 90000 | 85000 | 80000 | 75000 | 65000 |
| 37000 | TIME/FUEL<br>DIST./TAS | | | 42/ 5700<br>263/395 | 34/ 4700<br>206/391 | 29/ 4100<br>174/389 | 25/ 3700<br>151/388 | 23/ 3300<br>133/386 | 20/ 3000<br>119/385 | 18/ 2700<br>107/384 | 16/ 2500<br>96/384 | 13/ 2100<br>78/382 |
| 36000 | TIME/FUEL<br>DIST./TAS | | 43/ 5900<br>266/394 | 35/ 5000<br>211/391 | 30/ 4400<br>179/389 | 26/ 3900<br>156/387 | 23/ 3500<br>138/385 | 21/ 3200<br>123/384 | 19/ 2900<br>111/383 | 17/ 2700<br>100/383 | 16/ 2400<br>90/382 | 13/ 2000<br>74/381 |
| 35000 | TIME/FUEL<br>DIST./TAS | 45/ 6200<br>275/394 | 36/ 5300<br>219/390 | 31/ 4600<br>186/388 | 27/ 4100<br>162/386 | 24/ 3700<br>143/385 | 22/ 3400<br>128/384 | 20/ 3100<br>115/383 | 18/ 2800<br>104/382 | 16/ 2600<br>94/381 | 15/ 2400<br>85/380 | 12/ 2000<br>70/379 |
| 34000 | TIME/FUEL<br>DIST./TAS | 38/ 5600<br>228/390 | 32/ 4900<br>193/387 | 28/ 4400<br>168/386 | 25/ 3900<br>149/384 | 23/ 3600<br>133/383 | 21/ 3300<br>120/382 | 19/ 3000<br>108/381 | 17/ 2700<br>98/380 | 16/ 2500<br>89/379 | 14/ 2300<br>81/379 | 12/ 1900<br>67/378 |
| 33000 | TIME/FUEL<br>DIST./TAS | 34/ 5100<br>200/387 | 30/ 4600<br>174/385 | 26/ 4100<br>154/383 | 24/ 3800<br>138/382 | 22/ 3400<br>124/381 | 20/ 3100<br>113/380 | 18/ 2900<br>102/379 | 16/ 2600<br>93/378 | 15/ 2400<br>85/378 | 14/ 2200<br>77/377 | 11/ 1900<br>64/376 |
| 32000 | TIME/FUEL<br>DIST./TAS | 31/ 4800<br>180/384 | 28/ 4400<br>160/382 | 25/ 4000<br>143/381 | 23/ 3600<br>129/379 | 21/ 3300<br>116/378 | 19/ 3000<br>106/378 | 17/ 2800<br>96/377 | 16/ 2600<br>88/376 | 14/ 2400<br>80/376 | 13/ 2200<br>73/375 | 11/ 1800<br>61/374 |
| 31000 | TIME/FUEL<br>DIST./TAS | 29/ 4600<br>165/381 | 26/ 4200<br>147/379 | 23/ 3800<br>133/378 | 21/ 3500<br>120/377 | 20/ 3200<br>109/376 | 18/ 2900<br>100/375 | 16/ 2700<br>91/375 | 15/ 2500<br>83/374 | 14/ 2300<br>76/374 | 13/ 2100<br>70/373 | 11/ 1800<br>58/372 |
| 30000 | TIME/FUEL<br>DIST./TAS | 27/ 4400<br>152/378 | 24/ 4000<br>137/376 | 22/ 3700<br>124/375 | 20/ 3400<br>113/374 | 19/ 3100<br>103/374 | 17/ 2900<br>94/373 | 16/ 2600<br>86/372 | 14/ 2400<br>79/372 | 13/ 2200<br>72/371 | 12/ 2100<br>66/371 | 10/ 1700<br>55/370 |
| 29000 | TIME/FUEL<br>DIST./TAS | 25/ 4200<br>141/375 | 23/ 3800<br>128/374 | 21/ 3500<br>116/373 | 19/ 3200<br>106/372 | 18/ 3000<br>97/371 | 16/ 2800<br>89/370 | 15/ 2600<br>82/370 | 14/ 2400<br>75/369 | 13/ 2200<br>69/369 | 12/ 2000<br>63/369 | 10/ 1700<br>52/368 |
| 28000 | TIME/FUEL<br>DIST./TAS | 24/ 4000<br>131/371 | 22/ 3700<br>119/370 | 20/ 3400<br>109/369 | 18/ 3100<br>100/369 | 17/ 2900<br>91/368 | 16/ 2700<br>84/368 | 14/ 2500<br>77/367 | 13/ 2300<br>71/367 | 12/ 2100<br>65/366 | 11/ 1900<br>60/366 | 9/ 1600<br>50/365 |
| 27000 | TIME/FUEL<br>DIST./TAS | 22/ 3800<br>121/368 | 21/ 3500<br>111/367 | 19/ 3300<br>102/366 | 18/ 3000<br>93/366 | 16/ 2800<br>86/365 | 15/ 2600<br>79/364 | 14/ 2400<br>73/364 | 13/ 2200<br>67/364 | 12/ 2000<br>61/363 | 11/ 1900<br>56/363 | 9/ 1600<br>47/363 |
| 26000 | TIME/FUEL<br>DIST./TAS | 21/ 3600<br>110/363 | 19/ 3400<br>101/362 | 18/ 3100<br>93/362 | 16/ 2900<br>86/361 | 15/ 2700<br>79/361 | 14/ 2500<br>73/360 | 13/ 2300<br>67/360 | 12/ 2100<br>62/360 | 11/ 2000<br>57/359 | 10/ 1800<br>52/359 | 9/ 1500<br>44/359 |
| 25000 | TIME/FUEL<br>DIST./TAS | 19/ 3400<br>101/358 | 18/ 3200<br>93/358 | 17/ 3000<br>85/357 | 15/ 2800<br>79/357 | 14/ 2600<br>73/357 | 13/ 2400<br>67/356 | 12/ 2200<br>62/356 | 11/ 2000<br>57/356 | 10/ 1900<br>53/356 | 10/ 1700<br>48/355 | 8/ 1500<br>41/355 |
| 24000 | TIME/FUEL<br>DIST./TAS | 18/ 3300<br>92/354 | 17/ 3000<br>85/354 | 16/ 2800<br>78/353 | 15/ 2600<br>72/353 | 13/ 2400<br>67/353 | 12/ 2300<br>62/352 | 12/ 2100<br>57/352 | 11/ 1900<br>53/352 | 10/ 1800<br>49/352 | 9/ 1700<br>45/352 | 8/ 1400<br>38/351 |
| 23000 | TIME/FUEL<br>DIST./TAS | 17/ 3100<br>84/350 | 16/ 2900<br>78/350 | 15/ 2700<br>72/350 | 14/ 2500<br>67/349 | 13/ 2300<br>62/349 | 12/ 2200<br>57/349 | 11/ 2000<br>53/349 | 10/ 1900<br>49/348 | 9/ 1700<br>45/348 | 9/ 1600<br>42/348 | 7/ 1300<br>35/348 |
| 22000 | TIME/FUEL<br>DIST./TAS | 16/ 3000<br>77/346 | 15/ 2800<br>71/346 | 14/ 2600<br>66/346 | 13/ 2400<br>61/346 | 12/ 2200<br>57/345 | 11/ 2100<br>53/345 | 10/ 1900<br>49/345 | 10/ 1800<br>45/345 | 9/ 1700<br>42/345 | 8/ 1500<br>38/345 | 7/ 1300<br>32/344 |
| 21000 | TIME/FUEL<br>DIST./TAS | 15/ 2800<br>70/343 | 14/ 2600<br>65/343 | 13/ 2400<br>61/342 | 12/ 2300<br>56/342 | 11/ 2100<br>52/342 | 10/ 2000<br>49/342 | 10/ 1800<br>45/342 | 9/ 1700<br>42/342 | 8/ 1600<br>39/341 | 8/ 1500<br>36/341 | 6/ 1200<br>30/341 |
| 20000 | TIME/FUEL<br>DIST./TAS | 14/ 2700<br>64/339 | 13/ 2500<br>60/339 | 12/ 2300<br>56/339 | 11/ 2200<br>52/339 | 11/ 2000<br>48/339 | 10/ 1900<br>45/338 | 9/ 1800<br>41/338 | 8/ 1600<br>38/338 | 8/ 1500<br>36/338 | 7/ 1400<br>33/338 | 6/ 1200<br>28/338 |
| 19000 | TIME/FUEL<br>DIST./TAS | 13/ 2500<br>59/336 | 12/ 2400<br>55/336 | 11/ 2200<br>51/336 | 11/ 2100<br>47/335 | 10/ 1900<br>44/335 | 9/ 1800<br>41/335 | 9/ 1700<br>38/335 | 8/ 1600<br>35/335 | 7/ 1400<br>33/335 | 7/ 1300<br>30/335 | 6/ 1100<br>25/335 |
| 18000 | TIME/FUEL<br>DIST./TAS | 12/ 2400<br>53/333 | 11/ 2300<br>50/333 | 11/ 2100<br>46/332 | 10/ 2000<br>43/332 | 9/ 1800<br>40/332 | 9/ 1700<br>38/332 | 8/ 1600<br>35/332 | 8/ 1500<br>32/332 | 7/ 1400<br>30/332 | 6/ 1300<br>28/332 | 5/ 1100<br>23/332 |
| 17000 | TIME/FUEL<br>DIST./TAS | 11/ 2300<br>49/330 | 11/ 2100<br>45/329 | 10/ 2000<br>42/329 | 9/ 1900<br>39/329 | 9/ 1700<br>37/329 | 8/ 1600<br>34/329 | 8/ 1500<br>32/329 | 7/ 1400<br>30/329 | 7/ 1300<br>27/329 | 6/ 1200<br>25/329 | 5/ 1000<br>21/329 |
| 16000 | TIME/FUEL<br>DIST./TAS | 11/ 2200<br>44/327 | 10/ 2000<br>41/326 | 9/ 1900<br>38/326 | 9/ 1800<br>36/326 | 8/ 1700<br>33/326 | 8/ 1500<br>31/326 | 7/ 1400<br>29/326 | 7/ 1300<br>27/326 | 6/ 1200<br>25/326 | 6/ 1200<br>23/326 | 5/ 1000<br>19/326 |
| 15000 | TIME/FUEL<br>DIST./TAS | 10/ 2000<br>40/324 | 9/ 1900<br>37/324 | 9/ 1800<br>35/323 | 8/ 1700<br>33/323 | 8/ 1600<br>30/323 | 7/ 1500<br>28/323 | 7/ 1400<br>26/323 | 6/ 1300<br>24/323 | 6/ 1200<br>23/323 | 5/ 1100<br>21/323 | 5/ 900<br>18/323 |
| 14000 | TIME/FUEL<br>DIST./TAS | 9/ 1900<br>36/321 | 9/ 1800<br>34/321 | 8/ 1700<br>31/321 | 8/ 1600<br>29/321 | 7/ 1500<br>27/321 | 7/ 1400<br>26/321 | 6/ 1300<br>24/320 | 6/ 1200<br>22/320 | 5/ 1100<br>20/320 | 5/ 1000<br>19/320 | 4/ 900<br>16/320 |
| 13000 | TIME/FUEL<br>DIST./TAS | 9/ 1800<br>32/318 | 8/ 1700<br>30/318 | 8/ 1600<br>28/318 | 7/ 1500<br>26/318 | 7/ 1400<br>25/318 | 6/ 1300<br>23/318 | 6/ 1200<br>21/318 | 5/ 1100<br>20/318 | 5/ 1100<br>18/318 | 5/ 1000<br>17/318 | 4/ 800<br>14/318 |
| 12000 | TIME/FUEL<br>DIST./TAS | 8/ 1700<br>29/315 | 8/ 1600<br>27/315 | 7/ 1500<br>25/315 | 7/ 1400<br>23/315 | 6/ 1300<br>22/315 | 6/ 1200<br>20/315 | 5/ 1100<br>19/315 | 5/ 1100<br>18/315 | 5/ 1000<br>16/315 | 4/ 900<br>15/315 | 4/ 800<br>13/315 |
| 11000 | TIME/FUEL<br>DIST./TAS | 7/ 1600<br>25/313 | 7/ 1500<br>24/313 | 7/ 1400<br>22/313 | 6/ 1300<br>21/313 | 6/ 1200<br>19/313 | 5/ 1200<br>18/313 | 5/ 1100<br>17/313 | 5/ 1000<br>16/313 | 4/ 900<br>15/313 | 4/ 900<br>13/313 | 3/ 700<br>11/313 |
| 10000 | TIME/FUEL<br>DIST./TAS | 7/ 1500<br>22/310 | 6/ 1400<br>20/310 | 6/ 1300<br>19/310 | 6/ 1200<br>18/310 | 5/ 1200<br>17/310 | 5/ 1100<br>16/310 | 5/ 1000<br>15/310 | 4/ 900<br>14/310 | 4/ 900<br>13/310 | 4/ 800<br>12/310 | 3/ 700<br>10/310 |
| 8000 | TIME/FUEL<br>DIST./TAS | 6/ 1300<br>16/305 | 5/ 1200<br>15/305 | 5/ 1100<br>14/305 | 5/ 1100<br>13/305 | 4/ 1000<br>12/305 | 4/ 900<br>11/305 | 4/ 900<br>11/305 | 4/ 800<br>10/305 | 3/ 800<br>9/305 | 3/ 700<br>9/305 | 3/ 600<br>7/305 |
| 6000 | TIME/FUEL<br>DIST./TAS | 5/ 1100<br>10/301 | 4/ 1000<br>10/301 | 4/ 900<br>9/301 | 4/ 900<br>9/301 | 4/ 800<br>8/301 | 3/ 800<br>8/301 | 3/ 700<br>7/301 | 3/ 700<br>7/301 | 3/ 600<br>6/301 | 3/ 600<br>6/301 | 2/ 500<br>5/301 |
| 1500 | TIME/FUEL | 3/ 600 | 2/ 600 | 2/ 500 | 2/ 500 | 2/ 500 | 2/ 500 | 2/ 400 | 2/ 400 | 2/ 400 | 1/ 300 | 1/ 300 |

FUEL ADJUSTMENT FOR HIGH ELEVATION AIRPORTS

EFFECT ON TIME AND DISTANCE IS NEGLIGIBLE

| AIRPORT ELEVATION | 2000 | 4000 | 6000 | 8000 | 10000 | 12000 |
|---|---|---|---|---|---|---|
| FUEL ADJUSTMENT | -100 | -300 | -400 | -500 | -600 | -800 |

FIGURE 63.—En Route Climb 280/.70 ISA +10° C.

| OPERATING CONDITIONS | T-1 | T-2 | T-3 | T-4 | T-5 |
|---|---|---|---|---|---|
| TOTAL AIR TEMP (TAT) | +10° C | 0° C | –15° C | -30° C | +15° C |
| ALTITUDE | 10,000 | 5,000 | 25,000 | 35,000 | 18,000 |
| ENGINE ANTI-ICE | ON | ON | ON | ON | OFF |
| WING ANTI-ICE | OFF | 2 ON | 2 ON | 1 ON | OFF |
| AIR CONDITIONING | ON | OFF | ON | ON | OFF |

FIGURE 64.—B-737 Climb and Cruise Power.

| OPERATING CONDITIONS | W-1 | W-2 | W-3 | W-4 | W-5 |
|---|---|---|---|---|---|
| CLIMB SCHEDULE | LR | HS | LR | HS | HS |
| INITIAL WEIGHT (X1000) | 84 | 86 | 78 | 88 | 92 |
| CRUISE PRESS ALTITUDE | 34,000 | 28,000 | 32,000 | 22,000 | 24,000 |
| ISA TEMPERATURE | ISA | ISA | ISA | ISA | ISA |
| AVG WIND COMP (KTS) | 20 HW | 30 HW | 10 TW | 20 TW | 40 HW |

FIGURE 65.—DC-9 En Route Climb.

## EN ROUTE

### MAX CLIMB & MAX CONTINUOUS EPR

A/C AIRBLEED ON

| MAX. CLIMB | MAX. CONT. | TAT °C -40 | -35 | -30 | -25 | -20 | -15 | -10 | - 5 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S.L TO 30000 | S.L TO 1500<br>20000 TO 30000 | 2.25 | 2.23 | 2.21 | 2.18 | 2.15 | 2.12 | 2.09 | 2.04 | 1.99 | 1.94 | 1.90 | 1.86 | 1.82 | 1.79 | 1.76 | 1.73 | 1.70 | 1.67 | 1.64 |
| | 1500 TO 20000 | 2.30 | 2.28 | 2.26 | 2.24 | 2.21 | 2.19 | 2.16 | 2.13 | 2.10 | 2.07 | 2.04 | 2.00 | 1.95 | 1.91 | 1.86 | 1.81 | 1.75 | 1.71 | 1.66 |
| 35000 & 37000 | | 2.24 | 2.22 | 2.20 | 2.17 | 2.14 | 2.11 | 2.07 | 2.02 | 1.97 | 1.92 | | | | | | | | | |

PRESS LIMIT EPR:

| 2.30 | 2.20 | 2.14 | 2.09 | 2.04 | 1.98 |
|---|---|---|---|---|---|
| 5660 AND ABOVE | 4000 | 3000 | 2000 | 1000 | S.L. |

TEMP LIMIT EPR

①FIND TEMP LIMIT EPR
②FIND PRESS LIMIT EPR
③USE THE SMALLER OF THE TWO LIMITS

### MAX CRUISE EPR

A/C AIRBLEED ON

| TAT °C | | -50 | -45 | -40 | -35 | -30 | -25 | -20 | -15 | -10 | - 5 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PRESS ALT 1000 FT | 6 TO 30 | 2.18 | 2.16 | 2.14 | 2.12 | 2.10 | 2.07 | 2.05 | 2.02 | 1.99 | 1.95 | 1.91 | 1.85 | 1.79 | 1.73 | 1.68 | 1.64 | 1.61 | 1.57 | 1.54 |
| | 35 & 37 | 2.28 | 2.26 | 2.24 | 2.22 | 2.20 | 2.17 | 2.14 | 2.11 | 2.07 | 2.02 | 1.97 | 1.92 | 1.87 | 1.84 | 1.80 | | | | |

| ANTI-ICE BLEED CORRECTIONS | | Δ EPR |
|---|---|---|
| ENGINE ANTI-ICE | | - .08 |
| WING ANTI-ICE | | 2 ENG -.04 |
| | | 1 ENG -.06 |

| AIR COND-BLEED CORRECTIONS Δ EPR | A/C OFF |
|---|---|
| S. L TO 37000 | + .04 |

BLEED CORRECTIONS APPLY TO MAX CLIMB, MAX CONTINUOUS, AND MAX CRUISE EPR SETTINGS

FIGURE 66.—Climb and Cruise Power.

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## TIME, FUEL, AND DISTANCE TO CLIMB
## JT8D-1 ENGINES — NORMAL BLEED
## DC-9 SERIES 10 — HIGH SPEED CLIMB SCHEDULE
## CLIMB AT 320 KNOTS IAS TO 23500 FT ALTITUDE THEN CLIMB AT M .74

| INITIAL WEIGHT = 86000. POUNDS | | | | INITIAL WEIGHT = 90000. POUNDS | | | |
|---|---|---|---|---|---|---|---|
| PRES. ALT. FEET | TIME MIN. | FUEL BURNED LB. | DIST. N. MI. | PRES. ALT. FEET | TIME MIN. | FUEL BURNED LB. | DIST. N. MI. |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 2000. | 0.5 | 133. | 2.8 | 2000. | 0.6 | 140. | 3.0 |
| 4000. | 1.1 | 267. | 5.9 | 4000. | 1.1 | 282. | 6.3 |
| 6000. | 1.7 | 403. | 9.3 | 6000. | 1.8 | 426. | 9.8 |
| 8000. | 2.3 | 541. | 13.0 | 8000. | 2.5 | 573. | 13.8 |
| 10000. | 3.0 | 684. | 17.2 | 10000. | 3.2 | 724. | 18.2 |
| 12000. | 3.8 | 830. | 21.8 | 12000. | 4.0 | 879. | 23.1 |
| 14000. | 4.6 | 982. | 27.0 | 14000. | 4.8 | 1041. | 28.6 |
| 16000. | 5.5 | 1141. | 32.9 | 16000. | 5.8 | 1211. | 34.9 |
| 18000. | 6.4 | 1309. | 39.6 | 18000. | 6.9 | 1390. | 42.1 |
| 20000. | 7.6 | 1489. | 47.4 | 20000. | 8.0 | 1583. | 50.4 |
| 22000. | 8.8 | 1684. | 56.6 | 22000. | 9.4 | 1793. | 60.3 |
| 23500. | 9.9 | 1845. | 64.7 | 23500. | 10.6 | 1968. | 69.1 |
| 23500. | 9.9 | 1845. | 64.7 | 23500. | 10.6 | 1968. | 69.1 |
| 24000. | 10.2 | 1886. | 68.8 | 24000. | 10.9 | 2013. | 71.5 |
| 26000. | 11.4 | 2052. | 75.9 | 26000. | 12.3 | 2196. | 81.5 |
| 28000. | 12.8 | 2225. | 85.8 | 28000. | 13.8 | 2389. | 92.6 |
| 30000. | 14.3 | 2410. | 97.1 | 30000. | 15.5 | 2598. | 105.4 |
| 32000. | 16.2 | 2613. | 110.3 | 32000. | 17.6 | 2833. | 120.6 |
| 34000. | 18.4 | 2844. | 126.3 | 34000. | 20.3 | 3110. | 139.8 |
| 36000. | 21.4 | 3136. | 147.8 | 36000. | 24.3 | 3494. | 168.0 |
| INITIAL WEIGHT = 88000. POUNDS | | | | INITIAL WEIGHT = 92000. POUNDS | | | |
| 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| 2000. | 0.5 | 136. | 2.9 | 2000. | 0.6 | 144. | 3.1 |
| 4000. | 1.1 | 274. | 6.1 | 4000. | 1.2 | 290. | 6.4 |
| 6000. | 1.7 | 414. | 9.6 | 6000. | 1.8 | 438. | 10.1 |
| 8000. | 2.4 | 557. | 13.4 | 8000. | 2.5 | 589. | 14.2 |
| 10000. | 3.1 | 703. | 17.7 | 10000. | 3.3 | 744. | 18.7 |
| 12000. | 3.9 | 855. | 22.5 | 12000. | 4.1 | 905. | 23.8 |
| 14000. | 4.7 | 1012. | 27.8 | 14000. | 5.0 | 1072. | 29.5 |
| 16000. | 5.6 | 1176. | 33.9 | 16000. | 6.0 | 1247. | 36.0 |
| 18000. | 6.6 | 1349. | 40.8 | 18000. | 7.1 | 1432. | 43.4 |
| 20000. | 7.8 | 1535. | 48.9 | 20000. | 8.3 | 1631. | 52.0 |
| 22000. | 9.1 | 1738. | 58.4 | 22000. | 9.7 | 1850. | 62.3 |
| 23500. | 10.3 | 1906. | 66.9 | 23500. | 11.0 | 2032. | 71.5 |
| 23500. | 10.3 | 1906. | 66.9 | 23500. | 11.0 | 2032. | 71.5 |
| 24000. | 10.6 | 1949. | 69.1 | 24000. | 11.3 | 2079. | 73.9 |
| 26000. | 11.9 | 2123. | 78.6 | 26000. | 12.7 | 2272. | 84.4 |
| 28000. | 13.3 | 2306. | 89.1 | 28000. | 14.3 | 2476. | 96.2 |
| 30000. | 14.9 | 2502. | 101.2 | 30000. | 16.2 | 2693. | 109.8 |
| 32000. | 16.9 | 2720. | 115.3 | 32000. | 18.4 | 2951. | 126.2 |
| 34000. | 19.3 | 2973. | 132.8 | 34000. | 21.4 | 3258. | 147.4 |
| 36000. | 22.7 | 3304. | 157.2 | 36000. | 26.1 | 3713. | 181.0 |

FIGURE 67.—High-Speed Climb Schedule.

TIME, FUEL AND DISTANCE TO CLIMB
JT8D-1 ENGINES NORMAL BLEED
DC-9 SERIES 10 — LONG RANGE CLIMB SCHEDULE
CLIMB AT 290 KNOTS IAS TO 26860 FT ALTITUDE THEN CLIMB AT M .72

INITIAL WEIGHT = 78000. POUNDS

| PRES. ALT. FEET | TIME MIN. | FUEL BURNED LB. | DIST. N. MI. |
|---|---|---|---|
| 0. | 0. | 0. | 0. |
| 2000. | 0.5 | 113. | 2.2 |
| 4000. | 0.9 | 227. | 4.6 |
| 6000. | 1.5 | 342. | 7.3 |
| 8000. | 2.0 | 457. | 10.2 |
| 10000. | 2.6 | 574. | 13.3 |
| 12000. | 3.2 | 693. | 16.8 |
| 14000. | 3.9 | 815. | 20.7 |
| 16000. | 4.6 | 941. | 25.0 |
| 18000. | 5.4 | 1070. | 29.9 |
| 20000. | 6.3 | 1205. | 35.4 |
| 22000. | 7.2 | 1347. | 41.7 |
| 24000. | 8.3 | 1498. | 49.0 |
| 26000. | 9.5 | 1661. | 57.6 |
| 26860. | 10.1 | 1736. | 61.8 |
| 26860. | 10.1 | 1736. | 61.8 |
| 28000. | 10.7 | 1813. | 66.2 |
| 30000. | 11.9 | 1953. | 74.6 |
| 32000. | 13.3 | 2102. | 84.2 |
| 34000. | 14.9 | 2267. | 95.4 |
| 36000. | 16.9 | 2456. | 109.2 |

INITIAL WEIGHT = 82000. POUNDS

| PRES. ALT. FEET | TIME MIN. | FUEL BURNED LB. | DIST. N. MI. |
|---|---|---|---|
| 0. | 0. | 0. | 0. |
| 2000. | 0.5 | 120. | 2.4 |
| 4000. | 1.0 | 241. | 4.9 |
| 6000. | 1.5 | 363. | 7.7 |
| 8000. | 2.1 | 486. | 10.8 |
| 10000. | 2.7 | 610. | 14.2 |
| 12000. | 3.4 | 737. | 17.9 |
| 14000. | 4.1 | 868. | 22.1 |
| 16000. | 4.9 | 1002. | 26.7 |
| 18000. | 5.7 | 1141. | 31.9 |
| 20000. | 6.7 | 1286. | 37.9 |
| 22000. | 7.7 | 1439. | 44.6 |
| 24000. | 8.9 | 1602. | 52.5 |
| 26000. | 10.2 | 1780. | 61.9 |
| 26860. | 10.9 | 1863. | 66.5 |
| 26860. | 10.9 | 1863. | 66.5 |
| 28000. | 11.6 | 1948. | 71.4 |
| 30000. | 12.9 | 2104. | 80.8 |
| 32000. | 14.4 | 2274. | 91.7 |
| 34000. | 16.3 | 2464. | 104.6 |
| 36000. | 18.7 | 2693. | 121.3 |

INITIAL WEIGHT = 80000. POUNDS

| | | | |
|---|---|---|---|
| 0. | 0. | 0. | 0. |
| 2000. | 0.5 | 117. | 2.3 |
| 4000. | 1.0 | 234. | 4.8 |
| 6000. | 1.5 | 352. | 7.5 |
| 8000. | 2.1 | 471. | 10.5 |
| 10000. | 2.7 | 592. | 13.7 |
| 12000. | 3.3 | 715. | 17.4 |
| 14000. | 4.0 | 841. | 21.4 |
| 16000. | 4.7 | 971. | 25.9 |
| 18000. | 5.6 | 1105. | 30.9 |
| 20000. | 6.5 | 1245. | 36.6 |
| 22000. | 7.5 | 1392. | 43.2 |
| 24000. | 8.6 | 1549. | 50.7 |
| 26000. | 9.9 | 1719. | 59.7 |
| 26860. | 10.5 | 1798. | 64.1 |
| 26860. | 10.5 | 1798. | 64.1 |
| 28000. | 11.1 | 1879. | 68.7 |
| 30000. | 12.4 | 2027. | 77.7 |
| 32000. | 13.8 | 2186. | 87.8 |
| 34000. | 15.8 | 2362. | 99.8 |
| 36000. | 17.7 | 2570. | 114.9 |

INITIAL WEIGHT = 84000. POUNDS

| | | | |
|---|---|---|---|
| 0. | 0. | 0. | 0. |
| 2000. | 0.5 | 124. | 2.4 |
| 4000. | 1.0 | 248. | 5.1 |
| 6000. | 1.6 | 374. | 8.0 |
| 8000. | 2.2 | 500. | 11.1 |
| 10000. | 2.8 | 629. | 14.6 |
| 12000. | 3.5 | 760. | 18.5 |
| 14000. | 4.2 | 894. | 22.8 |
| 16000. | 5.1 | 1033. | 27.6 |
| 18000. | 5.9 | 1177. | 33.0 |
| 20000. | 6.9 | 1327. | 39.1 |
| 22000. | 8.0 | 1486. | 46.2 |
| 24000. | 9.2 | 1656. | 54.4 |
| 26000. | 10.6 | 1841. | 64.1 |
| 26860. | 11.3 | 1928. | 69.0 |
| 26860. | 11.3 | 1928. | 69.0 |
| 28000. | 12.0 | 2018. | 74.1 |
| 30000. | 13.4 | 2183. | 84.1 |
| 32000. | 15.0 | 2364. | 95.7 |
| 34000. | 17.1 | 2570. | 109.7 |
| 36000. | 19.7 | 2826. | 128.3 |

FIGURE 68.—Long-Range Climb Schedule.

| OPERATING CONDITIONS | X-1 | X-2 | X-3 | X-4 | X-5 |
|---|---|---|---|---|---|
| DISTANCE (NM) | 2,000 | 2,400 | 1,800 | 2,800 | 1,200 |
| WIND COMPONENT (KTS) | 50 TW | 50 HW | 20 HW | 50 TW | 30 HW |
| CRUISE PRESS ALTITUDE | 27,000 | 35,000 | 20,000 | 29,000 | 37,000 |
| ISA TEMPERATURE | +10° | ISA | +20° | -10° | +10° |
| LANDING WEIGHT (X1000) | 70 | 75 | 75 | 65 | 90 |

FIGURE 69.—Flight Planning at .78 Mach Cruise.

| OPERATING CONDITIONS | Q-1 | Q-2 | Q-3 | Q-4 | Q-5 |
|---|---|---|---|---|---|
| WEIGHT (X1000) | 110 | 70 | 90 | 80 | 100 |
| PRESSURE ALTITUDE | 30,000 | 25,000 | 35,000 | 20,000 | 10,000 |
| TOTAL AIR TEMP (TAT) | -8° C | -23° C | -16° C | +4° C | -6° C |

FIGURE 70.—Turbulent Air RPM.

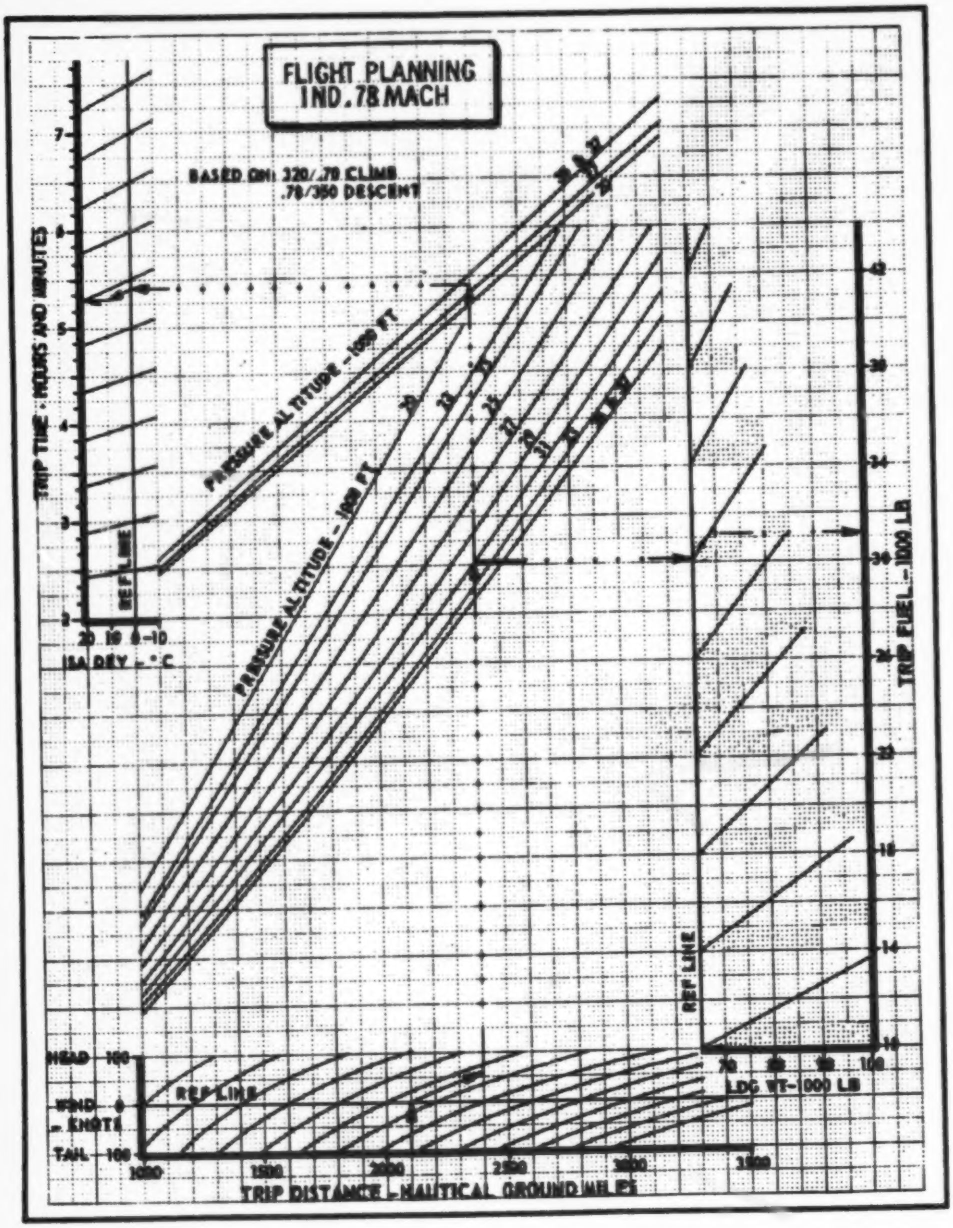


FIGURE 71.—Flight Planning .78 Mach Indicated.

| OPERATING CONDITIONS | Z-1 | Z-2 | Z-3 | Z-4 | Z-5 |
|---|---|---|---|---|---|
| DISTANCE (NM) | 340 | 650 | 900 | 290 | 400 |
| AVG WIND COMP (KTS) | 25 TW | 45 HW | 35 TW | 25 HW | 60 HW |

FIGURE 72.—Flight Planning at .74 Mach Cruise.

## TURBULENT AIR PENETRATION

| TARGET SPEED IAS/MACH | PRESS ALT -1000 FT | GROSS WEIGHT - 1000 LB | | | | | ISA TAT -°C | % $N_1$ ADJUSTMENT PER 10°C VARIATION FROM TABLE TAT COLDER - WARMER + |
|---|---|---|---|---|---|---|---|---|
| | | 70 | 80 | 90 | 100 | 110 | | |
| | | APPROXIMATE POWER SETTING -%$N_1$ RPM | | | | | | |
| 280/.70 | 35 | 77.1 | 79.0 | 81.0 | 83.4 | | -36 | 1.6 |
| | 30 | 77.2 | 78.2 | 79.4 | 81.1 | 82.4 | -23 | 1.6 |
| | 25 | 76.7 | 77.5 | 78.3 | 79.2 | 80.1 | -13 | 1.5 |
| | 20 | 74.7 | 75.4 | 76.1 | 77.0 | 77.9 | - 6 | 1.4 |
| | 15 | 72.7 | 73.5 | 74.2 | 74.8 | 75.7 | 1 | 1.2 |
| | 10 | 70.5 | 71.3 | 72.1 | 72.9 | 73.9 | 9 | 1.3 |

FIGURE 73.—Turbulent Air Penetration.

### ABBREVIATED FLIGHT PLANNING

.280/.70 CLIMB
.74/320/340 DESCENT
250 KTS CRUISE BELOW 10000 FT.
320 KTS CRUISE 10000 THRU 23000 FT.
.74 MACH CRUISE 24000 FT. AND ABOVE

| DIST. N. MI. | REC. ALT. | TAS KTS | AIR TIME MINS. | FUEL LBS. |
|---|---|---|---|---|
| 50 | 6000-7000 | 279 | 16 | 1800 |
| 60 | 6000-7000 | 279 | 18 | 1950 |
| 70 | 10000-11000 | 373 | 19 | 2000 |
| 80 | 10000-11000 | 373 | 20 | 2150 |
| 90 | 10000-11000 | 373 | 21 | 2250 |
| 100 | 10000-11000 | 373 | 23 | 2400 |
| 110 | 11000-12000 | 380 | 24 | 2550 |
| 120 | 12000-13000 | 386 | 25 | 2750 |
| 130 | 13000-14000 | 391 | 27 | 2900 |
| 140 | 14000-15000 | 396 | 28 | 3050 |
| 150 | 16000-17000 | 407 | 30 | 3200 |
| 160 | 17000-18000 | 414 | 31 | 3350 |
| 170 | 18000-19000 | 420 | 32 | 3500 |
| 180 | 19000-20000 | 426 | 33 | 3650 |
| 190 | 20000-21000 | 432 | 35 | 3800 |
| 200 | 21000-22000 | 439 | 36 | 3950 |
| 210 | 21000-22000 | 439 | 37 | 4050 |
| 220 | 22000-23000 | 446 | 39 | 4200 |
| 230 | 23000-24000 | 450 | 40 | 4300 |
| 240 | 24000-25000 | 450 | 41 | 4400 |
| 250 | 25000-26000 | 449 | 43 | 4500 |
| 260 | 26000-27000 | 447 | 44 | 4600 |
| 270 | 26000-27000 | 447 | 45 | 4750 |
| 280 | 27000-28000 | 445 | 47 | 4850 |
| 290 | 28000-29000 | 443 | 48 | 4950 |
| 300 | 28000-29000 | 443 | 49 | 5100 |
| 310 | 28000-29000 | 443 | 51 | 5200 |
| 320 | 29000-31000 | 441 | 52 | 5300 |
| 330 | 29000-31000 | 441 | 53 | 5400 |
| 340 | 31000-33000 | 438 | 55 | 5550 |
| 350 | 31000-33000 | 438 | 56 | 5650 |
| 400 | 33000-35000 | 433 | 62 | 6250 |
| 450 | 33000-35000 | 433 | 69 | 6850 |
| 500 | 33000-35000 | 433 | 76 | 7500 |
| 550 | 33000-35000 | 433 | 82 | 8100 |
| 600 | 33000-35000 | 433 | 89 | 8700 |
| 650 | 33000-35000 | 433 | 96 | 9300 |
| 700 | 33000-35000 | 433 | 102 | 9900 |
| 750 | 33000-35000 | 433 | 109 | 10500 |
| 800 | 33000-35000 | 433 | 115 | 11100 |
| 850 | 33000-35000 | 433 | 122 | 11700 |
| 900 | 33000-35000 | 433 | 129 | 12300 |
| 950 | 33000-35000 | 433 | 135 | 12900 |
| 1000 | 33000-35000 | 433 | 142 | 13500 |

TIME AND FUEL CORRECTION FOR WIND

△ TIME = TIME X WIND COMPONENT ÷ TAS
△ FUEL = FUEL X WIND COMPONENT ÷ TAS

EXAMPLE: DIST. = 250
STILL AIR TIME = 43 MIN.
STILL AIR FUEL = 4500 LBS.
WIND COMPONENT = 20 KTS.

△ TIME = 43 X 20 ÷ 449 = MIN.
△ FUEL = 4500 X 20 ÷ 449 = 200 LBS.
ADD △TIME AND△FUEL FOR HEADWIND; SUBTRACT FOR TAILWIND

FIGURE 74.—Abbreviated Flight Planning.

| OPERATING CONDITIONS | L-1 | L-2 | L-3 | L-4 | L-5 |
|---|---|---|---|---|---|
| WEIGHT (START TO ALT) | 85,000 | 70,000 | 86,000 | 76,000 | 82,000 |
| DISTANCE (NAM) | 110 | 190 | 330 | 50 | 240 |
| WIND COMPONENT (KTS) | 15 HW | 40 TW | 50 HW | 20 TW | 45 HW |
| HOLDING TIME AT ALT (MIN) | 15 | 15 | 15 | 15 | 15 |

FIGURE 75.—DC-9 Alternate Planning.

| OPERATING CONDITIONS | H-1 | H-2 | H-3 | H-4 | H-5 |
|---|---|---|---|---|---|
| ALTITUDE | 24,000 | 17,000 | 8,000 | 18,000 | 22,000 |
| WEIGHT (X1000) | 195 | 185 | 155 | 135 | 175 |
| ENGINES OPERATING | 3 | 3 | 3 | 3 | 3 |
| HOLDING TIME (MIN) | 15 | 30 | 45 | 25 | 35 |

FIGURE 76.—B-727 Holding.

| OPERATING CONDITIONS | O-1 | O-2 | O-3 | O-4 | O-5 |
|---|---|---|---|---|---|
| ALTITUDE | 31,000 | 23,000 | 17,000 | 8,000 | 4,000 |
| WEIGHT (X1000) | 102 | 93 | 104 | 113 | 109 |
| ENGINES OPERATING | 2 | 2 | 2 | 2 | 2 |
| HOLDING TIME (MIN) | 20 | 40 | 35 | 15 | 25 |

FIGURE 77.—B-737 Holding.

**ALTERNATE PLANNING CHART**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DIST. - NAM | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 |
| OPTM. ALT. | 2000 | 3000 | 4000 | 5000 | 6000 | 7000 | 8000 | 9000 | 10000 | 11000 | 12000 | 13000 | 14000 |
| TIME: | :16 | :17 | :19 | :20 | :22 | :23 | :25 | :26 | :28 | :29 | :30 | :32 | :33 |
| FUEL | 2500 | 2600 | 2700 | 2800 | 2900 | 3000 | 3100 | 3200 | 3300 | 3400 | 3500 | 3600 | 3700 |
| TAS | 275 | 280 | 283 | 286 | 289 | 292 | 296 | 300 | 303 | 306 | 309 | 312 | 315 |
| DIST. - NAM | 150 | 160 | 170 | 180 | 190 | 200 | 210 | 220 | 230 | 240 | 250 | 260 | 270 |
| OPTM. ALT. | 15000 | 16000 | 17000 | 18000 | 19000 | 20000 | 21000 | 22000 | 23000 | 24000 | 25000 | 26000 | 27000 |
| TIME | :35 | :36 | :38 | :39 | :40 | :42 | :43 | :45 | :46 | :48 | :49 | :50 | :52 |
| FUEL | 3800 | 3900 | 4000 | 4100 | 4200 | 4300 | 4400 | 4500 | 4600 | 4700 | 4800 | 4900 | 5000 |
| TAS | 319 | 323 | 326 | 330 | 334 | 338 | 341 | 345 | 349 | 353 | 357 | 361 | 365 |
| DIST. - NAM | 280 | 290 | 300 | 310 | 320 | 330 | 340 | 350 | 360 | 370 | 380 | 390 | 400 |
| OPTM. ALT. | 27000 | 28000 | 28000 | 29000 | 29000 | 30000 | 30000 | 31000 | 31000 | 31000 | 31000 | 31000 | 31000 |
| TIME | :53 | :55 | :56 | :58 | :59 | 1:00 | 1:02 | 1:03 | 1:04 | 1:05 | 1:07 | 1:08 | 1:10 |
| FUEL | 5150 | 5250 | 5350 | 5450 | 5600 | 5700 | 5800 | 5900 | 6050 | 6150 | 6250 | 6350 | 6500 |
| TAS | 368 | 372 | 376 | 380 | 385 | 388 | 392 | 397 | 397 | 397 | 397 | 397 | 397 |

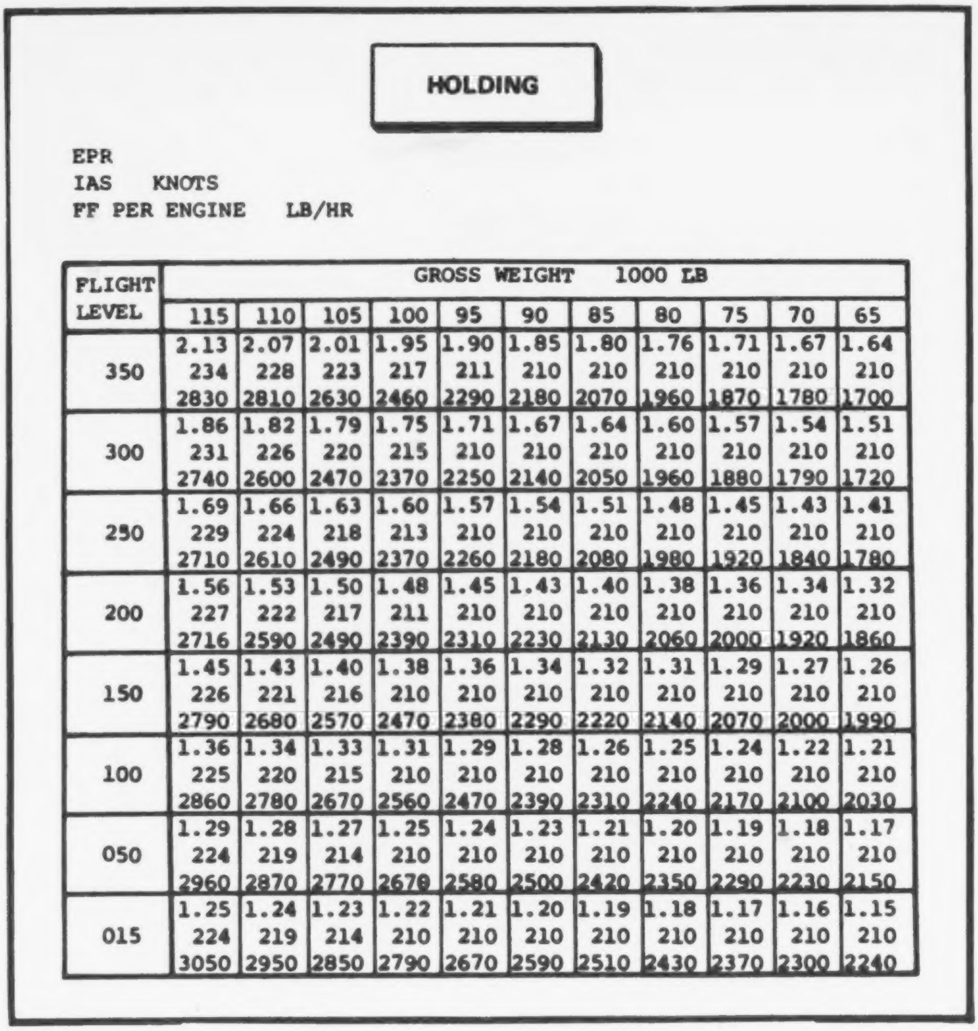
**NOTES:**

1. Fuel includes ½ climb distance enroute credit, fuel to cruise remaining distance at LRC schedule, 15 minutes holding at alternate, and 800 lbs. for descent.
2. Time includes ½ climb distance credit, time to cruise distance shown at LRC schedule and 8 minutes for descent. 15 minutes holding is not included in time.

FIGURE 78.—Alternate Planning Chart.

| EPR<br>IAS - KTS<br>FF PER ENG - LB/HR | HOLDING | | | | B–727 | | | | |
|---|---|---|---|---|---|---|---|---|---|
| PRESSURE ALTITUDE FT | GROSS WEIGHT - 1000 LB | | | | | | | | |
| | 200 | 190 | 180 | 170 | 160 | 150 | 140 | 130 | 120 |
| 25000 | 1.85<br>268<br>3600 | 1.81<br>261<br>3400 | 1.77<br>253<br>3210 | 1.73<br>246<br>3030 | 1.69<br>238<br>2860 | 1.64<br>230<br>2680 | 1.60<br>222<br>2510 | 1.55<br>213<br>2340 | 1.51<br>205<br>2180 |
| 20000 | 1.69<br>265<br>3630 | 1.66<br>258<br>3450 | 1.62<br>251<br>3280 | 1.59<br>244<br>3110 | 1.55<br>236<br>2940 | 1.51<br>228<br>2770 | 1.48<br>220<br>2600 | 1.44<br>212<br>2440 | 1.40<br>204<br>2270 |
| 15000 | 1.56<br>263<br>3670 | 1.53<br>256<br>3500 | 1.50<br>249<br>3340 | 1.47<br>242<br>3170 | 1.44<br>235<br>3000 | 1.41<br>227<br>2850 | 1.38<br>219<br>2680 | 1.35<br>211<br>2520 | 1.32<br>203<br>2350 |
| 10000 | 1.45<br>262<br>3800 | 1.43<br>255<br>3640 | 1.40<br>248<br>3460 | 1.38<br>241<br>3310 | 1.35<br>234<br>3140 | 1.33<br>226<br>2970 | 1.30<br>218<br>2810 | 1.28<br>210<br>2640 | 1.25<br>202<br>2480 |
| 5000 | 1.36<br>260<br>3890 | 1.34<br>254<br>3720 | 1.32<br>247<br>3550 | 1.30<br>240<br>3380 | 1.28<br>233<br>3220 | 1.26<br>225<br>3060 | 1.24<br>218<br>2890 | 1.22<br>210<br>2730 | 1.20<br>201<br>2560 |

FIGURE 79.—Holding Performance Chart.



HOLDING

EPR
IAS KNOTS
FF PER ENGINE LB/HR

| FLIGHT LEVEL | GROSS WEIGHT 1000 LB | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 115 | 110 | 105 | 100 | 95 | 90 | 85 | 80 | 75 | 70 | 65 |
| 350 | 2.13<br>234<br>2830 | 2.07<br>228<br>2810 | 2.01<br>223<br>2630 | 1.95<br>217<br>2460 | 1.90<br>211<br>2290 | 1.85<br>210<br>2180 | 1.80<br>210<br>2070 | 1.76<br>210<br>1960 | 1.71<br>210<br>1870 | 1.67<br>210<br>1780 | 1.64<br>210<br>1700 |
| 300 | 1.86<br>231<br>2740 | 1.82<br>226<br>2600 | 1.79<br>220<br>2470 | 1.75<br>215<br>2370 | 1.71<br>210<br>2250 | 1.67<br>210<br>2140 | 1.64<br>210<br>2050 | 1.60<br>210<br>1960 | 1.57<br>210<br>1880 | 1.54<br>210<br>1790 | 1.51<br>210<br>1720 |
| 250 | 1.69<br>229<br>2710 | 1.66<br>224<br>2610 | 1.63<br>218<br>2490 | 1.60<br>213<br>2370 | 1.57<br>210<br>2260 | 1.54<br>210<br>2180 | 1.51<br>210<br>2080 | 1.48<br>210<br>1980 | 1.45<br>210<br>1920 | 1.43<br>210<br>1840 | 1.41<br>210<br>1780 |
| 200 | 1.56<br>227<br>2716 | 1.53<br>222<br>2590 | 1.50<br>217<br>2490 | 1.48<br>211<br>2390 | 1.45<br>210<br>2310 | 1.43<br>210<br>2230 | 1.40<br>210<br>2130 | 1.38<br>210<br>2060 | 1.36<br>210<br>2000 | 1.34<br>210<br>1920 | 1.32<br>210<br>1860 |
| 150 | 1.45<br>226<br>2790 | 1.43<br>221<br>2680 | 1.40<br>216<br>2570 | 1.38<br>210<br>2470 | 1.36<br>210<br>2380 | 1.34<br>210<br>2290 | 1.32<br>210<br>2220 | 1.31<br>210<br>2140 | 1.29<br>210<br>2070 | 1.27<br>210<br>2000 | 1.26<br>210<br>1990 |
| 100 | 1.36<br>225<br>2860 | 1.34<br>220<br>2780 | 1.33<br>215<br>2670 | 1.31<br>210<br>2560 | 1.29<br>210<br>2470 | 1.28<br>210<br>2390 | 1.26<br>210<br>2310 | 1.25<br>210<br>2240 | 1.24<br>210<br>2170 | 1.22<br>210<br>2100 | 1.21<br>210<br>2030 |
| 050 | 1.29<br>224<br>2960 | 1.28<br>219<br>2870 | 1.27<br>214<br>2770 | 1.25<br>210<br>2670 | 1.24<br>210<br>2580 | 1.23<br>210<br>2500 | 1.21<br>210<br>2420 | 1.20<br>210<br>2350 | 1.19<br>210<br>2290 | 1.18<br>210<br>2230 | 1.17<br>210<br>2150 |
| 015 | 1.25<br>224<br>3050 | 1.24<br>219<br>2950 | 1.23<br>214<br>2850 | 1.22<br>210<br>2790 | 1.21<br>210<br>2670 | 1.20<br>210<br>2590 | 1.19<br>210<br>2510 | 1.18<br>210<br>2430 | 1.17<br>210<br>2370 | 1.16<br>210<br>2300 | 1.15<br>210<br>2240 |

FIGURE 80.—Holding Performance Chart.

| INITIAL FUEL WEIGHT 1000 LB | ENDING FUEL WEIGHT - 1000 LB | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10 | 14 | 18 | 22 | 26 | 30 | 34 | 38 | 42 | 46 | 50 | 54 | 58 | 62 | 66 | 70 |
| 70 | 28 | 27 | 25 | 23 | 22 | 20 | 18 | 17 | 15 | 13 | 12 | 10 | 8 | 5 | 3 | 0 |
| 66 | 26 | 25 | 23 | 21 | 20 | 18 | 16 | 15 | 13 | 11 | 10 | 8 | 5 | 3 | 0 | |
| 62 | 23 | 23 | 20 | 18 | 17 | 15 | 13 | 12 | 10 | 8 | 7 | 5 | 3 | 0 | | |
| 58 | 21 | 20 | 18 | 16 | 15 | 13 | 11 | 10 | 8 | 6 | 5 | 3 | 0 | | | |
| 54 | 18 | 16 | 15 | 13 | 12 | 10 | 8 | 7 | 5 | 3 | 2 | 0 | | | | |
| 50 | 16 | 15 | 13 | 12 | 10 | 8 | 7 | 5 | 3 | 2 | 0 | | | | | |
| 46 | 15 | 13 | 12 | 10 | 8 | 7 | 5 | 3 | 2 | 0 | | | | | | |
| 42 | 13 | 12 | 10 | 8 | 7 | 5 | 3 | 2 | 0 | | | | | | | |
| 38 | 12 | 10 | 8 | 7 | 5 | 3 | 2 | 0 | | | | | | | | |
| 34 | 10 | 8 | 7 | 5 | 3 | 2 | 0 | | | | | | | | | |
| 30 | 8 | 7 | 5 | 3 | 2 | 0 | | | | | | | | | | |
| 26 | 7 | 5 | 3 | 2 | 0 | | | | | | | | | | | |
| 22 | 5 | 3 | 2 | 0 | | | | | | | | | | | | |
| 18 | 3 | 2 | 0 | | | | | | | | | | | | | |
| 14 | 2 | 0 | | | | | | | | | | | | | | |
| 10 | 0 | | | | | | | | | | | | | | | |

FUEL DUMP TIME

FUEL JETTISON TIME-MINUTES

FIGURE 81.—Fuel Dump Time.

| OPERATING CONDITIONS | D-1 | D-2 | D-3 | D-4 | D-5 |
|---|---|---|---|---|---|
| WT AT ENG FAIL (X1000) | 100 | 110 | 90 | 80 | 120 |
| ENGINE ANTI-ICE | ON | OFF | ON | ON | ON |
| WING ANTI-ICE | OFF | OFF | ON | ON | OFF |
| ISA TEMPERATURE | ISA | +10° | -10° | -10° | +20° |
| AIR CONDITIONING | OFF | OFF | OFF | OFF | OFF |

FIGURE 82.—B-737 Drift-Down.

| OPERATING CONDITIONS | S-1 | S-2 | S-3 | S-4 | S-5 |
|---|---|---|---|---|---|
| FLIGHT LEVEL | 370 | 350 | 410 | 390 | 330 |
| LANDING WEIGHT (X1000) | 130 | 150 | 135 | 155 | 125 |
| DESCENT TYPE | .80M/ 250 | .80M/ 280/250 | .80M/ 320/250 | .85M/ 350/250 | .80M/ 320/250 |

FIGURE 83.—Descent Performance.

## 1 ENGINE INOP

ENGINE A/I OFF

| GROSS WEIGHT 1000 LB | | OPTIMUM DRIFTDOWN SPEED KIAS | ISA DEV °C | | | |
|---|---|---|---|---|---|---|
| AT ENGINE FAILURE | AT LEVEL OFF (APPROX) | | -10 | 0 | 10 | 20 |
| | | | APPROX GROSS LEVEL OFF PRESS ALT FT | | | |
| 80 | 77 | 184 | 27900 | 26800 | 25400 | 22800 |
| 90 | 86 | 195 | 25000 | 23800 | 21700 | 20000 |
| 100 | 96 | 206 | 22000 | 20500 | 20000 | 18500 |
| 110 | 105 | 216 | 20000 | 19100 | 17500 | 15400 |
| 120 | 114 | 224 | 18200 | 16600 | 14700 | 12200 |

ENGINE A/I ON

| GROSS WEIGHT 1000 LB | | OPTIMUM DRIFTDOWN SPEED KIAS | ISA DEV °C | | | |
|---|---|---|---|---|---|---|
| AT ENGINE FAILURE | AT LEVEL OFF (APPROX) | | -10 | 0 | 10 | 20 |
| | | | APPROX GROSS LEVEL OFF PRESS ALT FT | | | |
| 80 | 77 | 184 | 25500 | 24600 | 22800 | 20000 |
| 90 | 86 | 195 | 23000 | 21400 | 20000 | 19400 |
| 100 | 96 | 206 | 20000 | 19400 | 18700 | 15600 |
| 110 | 105 | 216 | 18100 | 16600 | 14700 | 12200 |
| 120 | 114 | 224 | 15500 | 13800 | 11800 | 8800 |

ENGINE AND WING A/I ON

| GROSS WEIGHT 1000 LB | | OPTIMUM DRIFTDOWN SPEED KIAS | ISA DEV °C | | | |
|---|---|---|---|---|---|---|
| AT ENGINE FAILURE | AT LEVEL OFF (APPROX) | | -10 | 0 | 10 | 20 |
| | | | APPROX GROSS LEVEL OFF PRESS ALT FT | | | |
| 80 | 77 | 184 | 24400 | 23400 | 21400 | 20000 |
| 90 | 86 | 195 | 21600 | 20100 | 19800 | 18000 |
| 100 | 96 | 206 | 19600 | 18000 | 16400 | 14200 |
| 110 | 105 | 216 | 16800 | 15100 | 13300 | 10700 |
| 120 | 114 | 224 | 14000 | 12200 | 10300 | 7200 |

NOTE:

WHEN ENGINE BLEED FOR AIR CONDITIONING
IS OFF BELOW 17,000 FT., INCREASE
LEVEL-OFF ALTITUDE BY 800 FT.

FIGURE 84.—Drift-Down Performance Chart.

### .80M/250 KIAS

| FLIGHT LEVEL | TIME MIN | FUEL LB | DISTANCE NAM | | |
|---|---|---|---|---|---|
| | | | AT LANDING WEIGHTS | | |
| | | | 120,000 LB | 140,000 LB | 160,000 LB |
| 410 | 27 | 1610 | 133 | 137 | 138 |
| 390 | 27 | 1600 | 130 | 134 | 136 |
| 370 | 26 | 1570 | 123 | 128 | 129 |
| 350 | 25 | 1540 | 116 | 120 | 122 |
| 330 | 24 | 1510 | 110 | 113 | 115 |
| 310 | 23 | 1480 | 103 | 107 | 108 |
| 290 | 22 | 1450 | 97 | 100 | 101 |
| 270 | 21 | 1420 | 90 | 93 | 95 |
| 250 | 20 | 1390 | 84 | 87 | 88 |
| 230 | 19 | 1360 | 78 | 80 | 81 |
| 210 | 18 | 1320 | 72 | 74 | 75 |
| 190 | 17 | 1280 | 66 | 68 | 68 |
| 170 | 16 | 1240 | 60 | 62 | 62 |
| 150 | 14 | 1190 | 54 | 56 | 56 |
| 100 | 11 | 1050 | 39 | 40 | 40 |
| 050 | 8 | 870 | 24 | 24 | 24 |
| 015 | 5 | 700 | 12 | 12 | 12 |

### .80M/280/250 KIAS

| FLIGHT LEVEL | TIME MIN | FUEL LB | DISTANCE NAM | | |
|---|---|---|---|---|---|
| | | | AT LANDING WEIGHTS | | |
| | | | 120,000 LB | 140,000 LB | 160,000 LB |
| 410 | 25 | 1550 | 123 | 129 | 132 |
| 390 | 24 | 1540 | 121 | 127 | 130 |
| 370 | 24 | 1520 | 115 | 121 | 125 |
| 350 | 23 | 1500 | 111 | 117 | 120 |
| 330 | 23 | 1480 | 106 | 111 | 115 |
| 310 | 22 | 1450 | 100 | 105 | 108 |
| 290 | 21 | 1430 | 94 | 99 | 102 |
| 270 | 20 | 1400 | 88 | 93 | 95 |
| 250 | 19 | 1370 | 83 | 87 | 89 |
| 230 | 18 | 1350 | 77 | 81 | 83 |
| 210 | 17 | 1310 | 72 | 75 | 76 |
| 190 | 16 | 1280 | 66 | 69 | 70 |
| 170 | 15 | 1240 | 61 | 63 | 64 |
| 150 | 14 | 1200 | 55 | 57 | 58 |
| 100 | 12 | 1080 | 42 | 42 | 42 |
| 050 | 8 | 870 | 24 | 24 | 24 |
| 015 | 5 | 700 | 12 | 12 | 12 |

### .80M/320/250 KIAS

| FLIGHT LEVEL | TIME MIN | FUEL LB | DISTANCE NAM | | |
|---|---|---|---|---|---|
| | | | AT LANDING WEIGHTS | | |
| | | | 120,000 LB | 140,000 LB | 160,000 LB |
| 410 | 22 | 1490 | 113 | 120 | 123 |
| 390 | 22 | 1480 | 111 | 117 | 121 |
| 370 | 21 | 1460 | 105 | 112 | 116 |
| 350 | 21 | 1440 | 101 | 107 | 111 |
| 330 | 20 | 1420 | 96 | 103 | 107 |
| 310 | 20 | 1400 | 92 | 98 | 102 |
| 290 | 19 | 1390 | 89 | 94 | 98 |
| 270 | 19 | 1370 | 85 | 90 | 94 |
| 250 | 18 | 1350 | 80 | 85 | 88 |
| 230 | 17 | 1330 | 75 | 79 | 82 |
| 210 | 17 | 1300 | 71 | 74 | 77 |
| 190 | 16 | 1270 | 66 | 69 | 71 |
| 170 | 15 | 1240 | 61 | 64 | 65 |
| 150 | 14 | 1210 | 56 | 59 | 60 |
| 100 | 12 | 1110 | 45 | 46 | 46 |
| 050 | 8 | 870 | 24 | 24 | 24 |
| 015 | 5 | 700 | 12 | 12 | 12 |

### .85M/350/250 KIAS

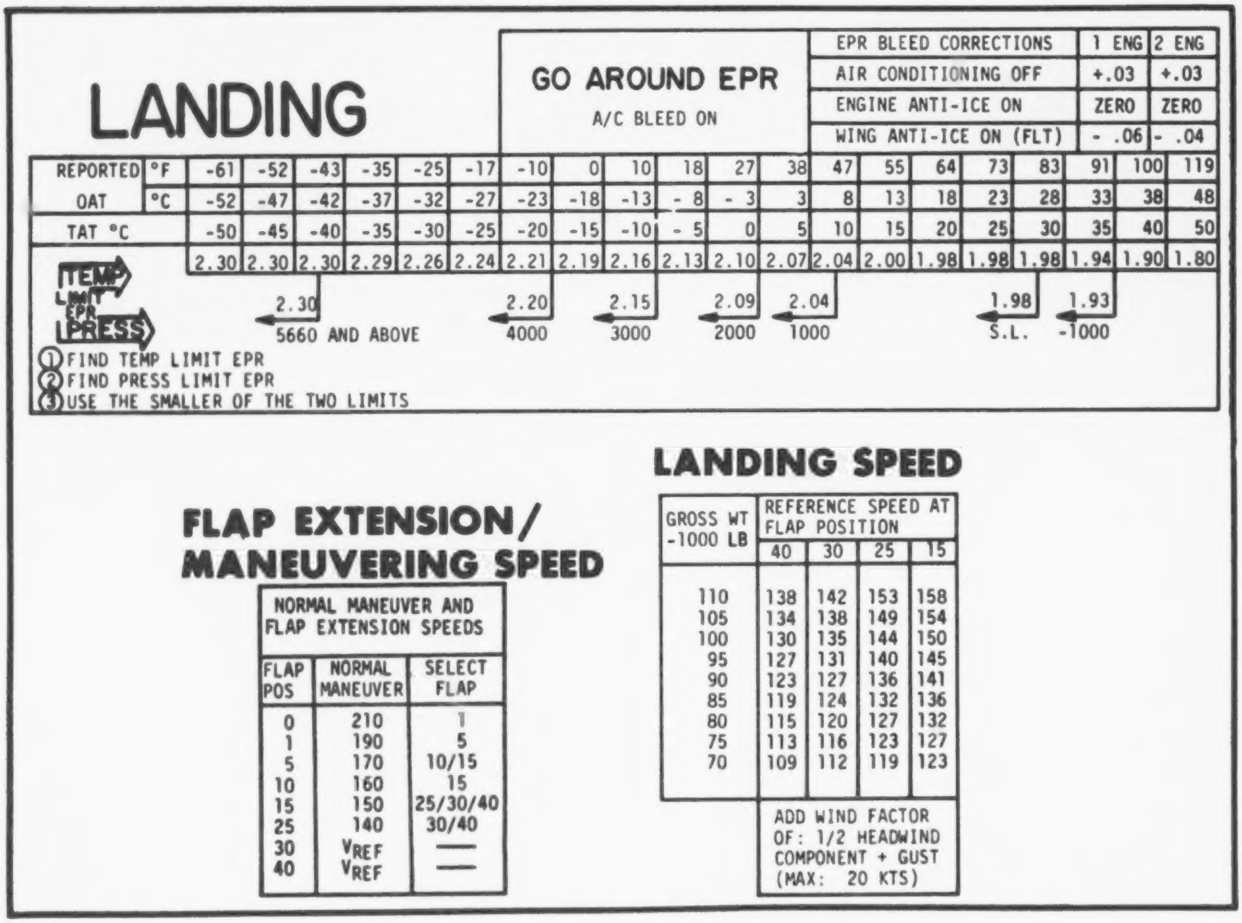
| FLIGHT LEVEL | TIME MIN | FUEL LB | DISTANCE NAM | | |
|---|---|---|---|---|---|
| | | | AT LANDING WEIGHTS | | |
| | | | 120,000 LB | 140,000 LB | 160,000 LB |
| 410 | 21 | 1440 | 106 | 112 | 116 |
| 390 | 21 | 1430 | 103 | 110 | 114 |
| 370 | 20 | 1420 | 99 | 106 | 110 |
| 350 | 20 | 1400 | 95 | 101 | 106 |
| 330 | 19 | 1390 | 91 | 98 | 102 |
| 310 | 19 | 1380 | 88 | 94 | 98 |
| 290 | 18 | 1360 | 85 | 90 | 95 |
| 270 | 18 | 1350 | 82 | 87 | 91 |
| 250 | 17 | 1330 | 78 | 83 | 87 |
| 230 | 17 | 1310 | 74 | 78 | 81 |
| 210 | 16 | 1290 | 70 | 74 | 76 |
| 190 | 16 | 1270 | 65 | 69 | 71 |
| 170 | 15 | 1240 | 61 | 64 | 66 |
| 150 | 14 | 1210 | 57 | 60 | 61 |
| 100 | 13 | 1130 | 47 | 48 | 49 |
| 050 | 8 | 870 | 24 | 24 | 24 |
| 015 | 5 | 700 | 12 | 12 | 12 |

NOTE: FUEL FOR A STRAIGHT-IN APPROACH IS INCLUDED.

FIGURE 85.—Descent Performance Chart.

| OPERATING CONDITIONS | L-1 | L-2 | L-3 | L-4 | L-5 |
|---|---|---|---|---|---|
| TEMPERATURE | +15° C TAT | +27° F OAT | -8° C OAT | -10° C TAT | +55° F OAT |
| PRESSURE ALTITUDE | 500 | 3,100 | 2,500 | 2,100 | 1,200 |
| AIR CONDITIONING | OFF | ON | ON | ON | ON |
| WING ANTI-ICE | OFF | 2 ON | 1 ON | 2 ON | OFF |
| WEIGHT (X1000) | 100 | 95 | 90 | 105 | 85 |
| FLAP SETTING | 30° | 25° | 15° | 40° | 30° |
| RUNWAY ASSIGNED | 35 | 04 | 27 | 34 | 09 |
| SURFACE WIND | 300/20 | 350/15 | 310/20 | 030/10 | 130/15 |

FIGURE 86.—B-727 Landing.



LANDING

GO AROUND EPR

A/C BLEED ON

| EPR BLEED CORRECTIONS | 1 ENG | 2 ENG |
|---|---|---|
| AIR CONDITIONING OFF | +.03 | +.03 |
| ENGINE ANTI-ICE ON | ZERO | ZERO |
| WING ANTI-ICE ON (FLT) | - .06 | - .04 |

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| REPORTED OAT °F | -61 | -52 | -43 | -35 | -25 | -17 | -10 | 0 | 10 | 18 | 27 | 38 | 47 | 55 | 64 | 73 | 83 | 91 | 100 | 119 |
| REPORTED OAT °C | -52 | -47 | -42 | -37 | -32 | -27 | -23 | -18 | -13 | - 8 | - 3 | 3 | 8 | 13 | 18 | 23 | 28 | 33 | 38 | 48 |
| TAT °C | -50 | -45 | -40 | -35 | -30 | -25 | -20 | -15 | -10 | - 5 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 50 |
| TEMP LIMIT EPR | 2.30 | 2.30 | 2.30 | 2.29 | 2.26 | 2.24 | 2.21 | 2.19 | 2.16 | 2.13 | 2.10 | 2.07 | 2.04 | 2.00 | 1.98 | 1.98 | 1.98 | 1.94 | 1.90 | 1.80 |

| PRESS | 5660 AND ABOVE | 4000 | 3000 | 2000 | 1000 | S.L. | -1000 |
|---|---|---|---|---|---|---|---|
| LIMIT EPR | 2.30 | 2.20 | 2.15 | 2.09 | 2.04 | 1.98 | 1.93 |

① FIND TEMP LIMIT EPR
② FIND PRESS LIMIT EPR
③ USE THE SMALLER OF THE TWO LIMITS

**FLAP EXTENSION/ MANEUVERING SPEED**

NORMAL MANEUVER AND FLAP EXTENSION SPEEDS

| FLAP POS | NORMAL MANEUVER | SELECT FLAP |
|---|---|---|
| 0 | 210 | 1 |
| 1 | 190 | 5 |
| 5 | 170 | 10/15 |
| 10 | 160 | 15 |
| 15 | 150 | 25/30/40 |
| 25 | 140 | 30/40 |
| 30 | $V_{REF}$ | — |
| 40 | $V_{REF}$ | — |

**LANDING SPEED**

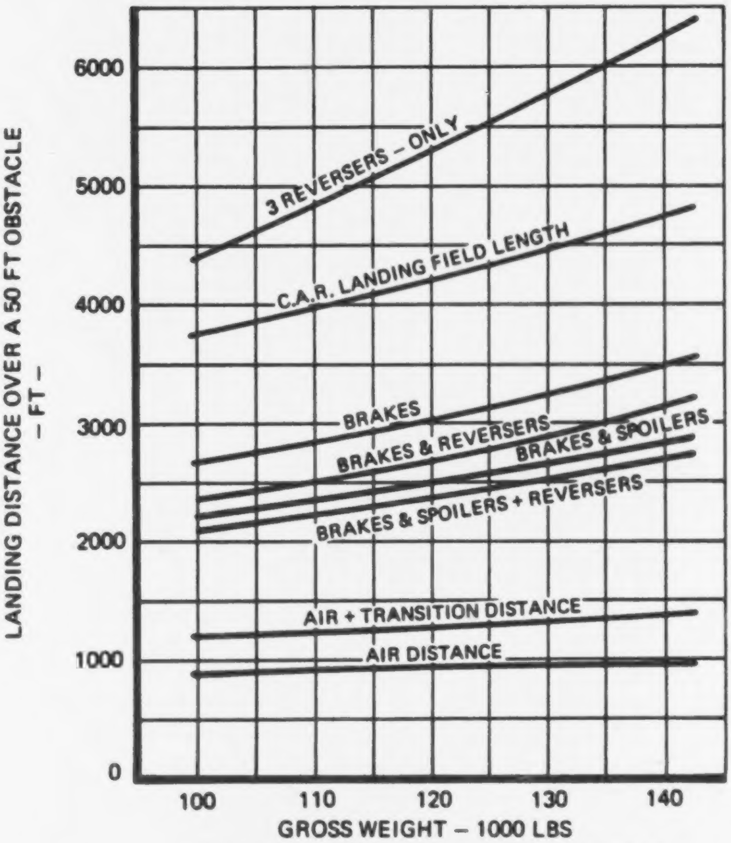
| GROSS WT -1000 LB | REFERENCE SPEED AT FLAP POSITION | | | |
|---|---|---|---|---|
| | 40 | 30 | 25 | 15 |
| 110 | 138 | 142 | 153 | 158 |
| 105 | 134 | 138 | 149 | 154 |
| 100 | 130 | 135 | 144 | 150 |
| 95 | 127 | 131 | 140 | 145 |
| 90 | 123 | 127 | 136 | 141 |
| 85 | 119 | 124 | 132 | 136 |
| 80 | 115 | 120 | 127 | 132 |
| 75 | 113 | 116 | 123 | 127 |
| 70 | 109 | 112 | 119 | 123 |

ADD WIND FACTOR OF: 1/2 HEADWIND COMPONENT + GUST (MAX: 20 KTS)

FIGURE 87.—Landing Performance Chart.

LANDING DISTANCE
COMPARISON
DRY RUNWAY

SEA LEVEL 59°F
40° FLAPS
ANTI-SKID OPERATIVE.
BRAKES & SPOILERS APPLIED
2 SECONDS AFTER TOUCHDOWN.
REVERSERS INITIATED
3 SECONDS AFTER TOUCHDOWN.
ENGINE SPIN-UP TIME FOR
REVERSE THRUST IS 0.3 SECONDS.
CERTIFIED LANDING PARAMETERS USED,
EXCEPT REVERSE THRUST WHICH IS
FLIGHT TEST DATA.



TRAINING INFORMATION ONLY REPRESENTATIVE

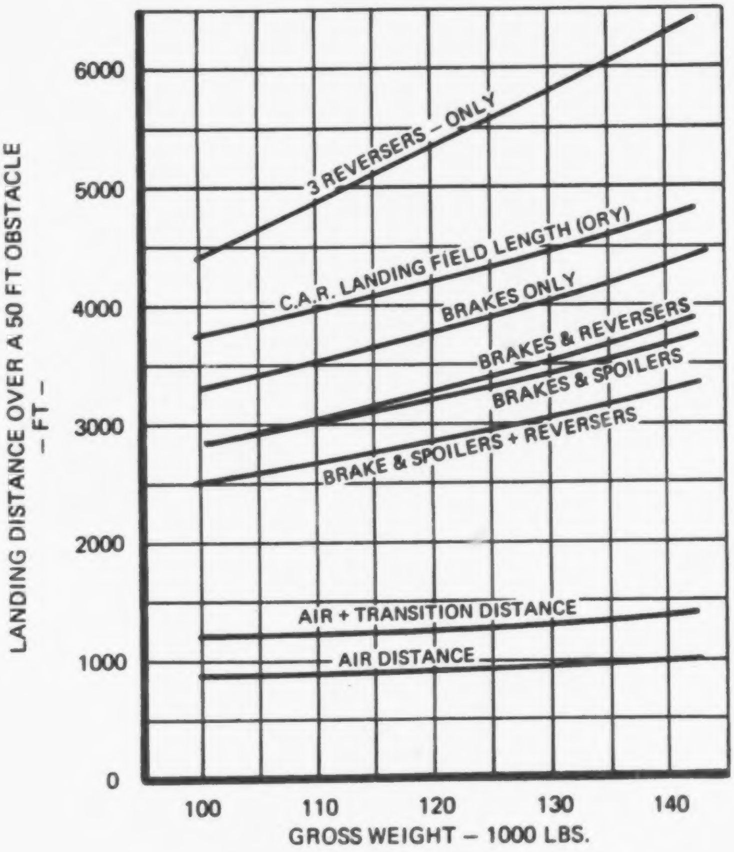
**NORMAL LANDING**

FIGURE 88.—Normal Landing - Dry Runway.

LANDING DISTANCE
COMPARISON

WET RUNWAY

SEA LEVEL 59°F
40° FLAPS
ANTI-SKID OPERATIVES.
BRAKES & SPOILERS APPLIED
2 SECONDS AFTER TOUCHDOWN.
REVERSERS INITIATED
3 SECONDS AFTER TOUCHDOWN.
ENGINE SPIN-UP TIME FOR
REVERSE THRUST IS 6.3 SECONDS.
CERTITIED LANDING PARAMETERS USED,
EXCEPT REVERSE THRUST WHICH IS
RIGHT
FLIGHT TEST DATA.



TRAINING INFORMATION ONLY REPRESENTATIVE

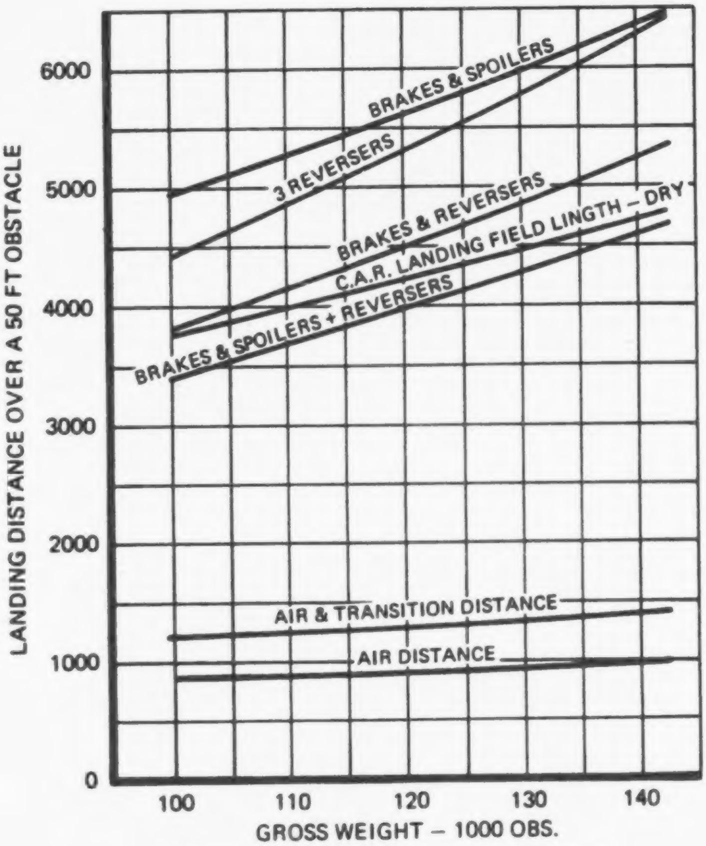
NORMAL LANDING

FIGURE 89.—Normal Landing - Wet Runway.

LANDING DISTANCE
COMPARISON

ICY RUNWAY

SEA LEVEL 59°F
40° FLAPS
ANTI-SKID OPERATIVE
BRAKES & SPOILERS APPLIED
2 SECONDS AFTER TOUCHDOWN
REVERSERS INITIATED
3 SECONDS AFTER TOUCHDOWN.
ENGINE SPIN-UP TIME FOR
REVERSE THRUST IS 6.3 SECONDS.
CERTIFIED LANDING PARAMETERS USED,
EXCEPT REVERSE THRUST WHICH IS
BASED ON FLIGHT TEST DATA.



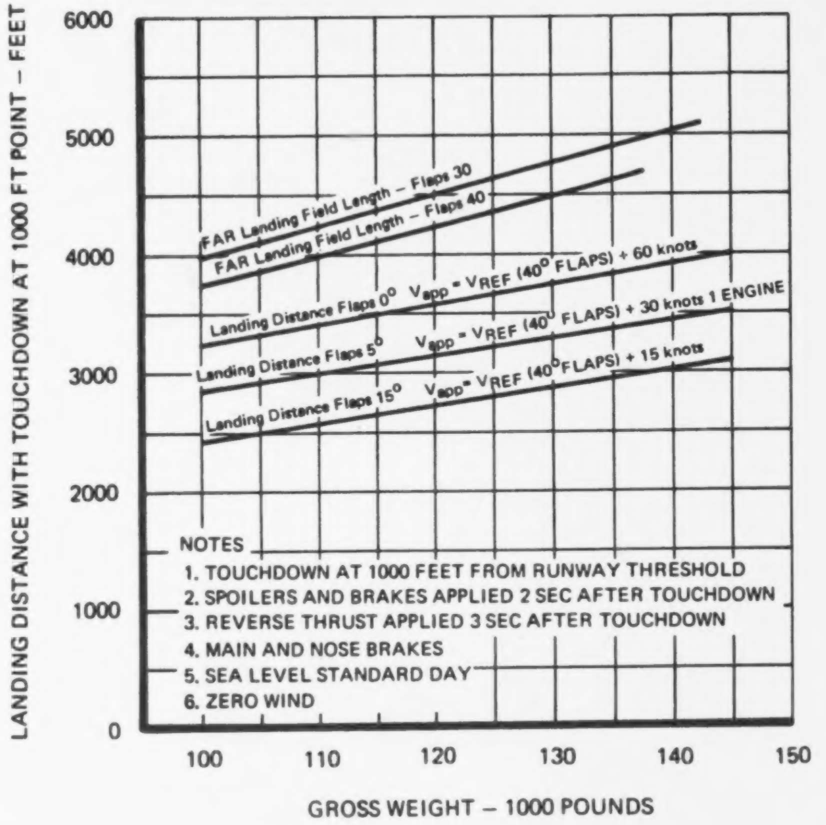
TRAINING INFORMATION ONLY REPRESENTATIVE

**NORMAL LANDING**

FIGURE 90.—Normal Landing - Icy Runway.

LANDING DISTANCE COMPARISON
FLAPS 0
FLAPS 5
FLAPS 15

TOUCHDOWN AT 1000 FEET FROM RUNWAY THRESHOLD
SPOILERS AND BRAKES APPLIED 2 SECONDS AFTER TOUCHDOWN
REVERSE THRUST APPLIED 3 SECONDS AFTER TOUCHDOWN
MAIN AND NOSE BRAKES
SEA LEVEL, STANDARD DAY
ZERO WIND, DRY RUNWAY
ANTI-SKID OPERATIVE



TRAINING INFORMATION ONLY REPRESENTATIVE

**NORMAL LANDING**

FIGURE 91.—Normal Landing Distance Comparison.

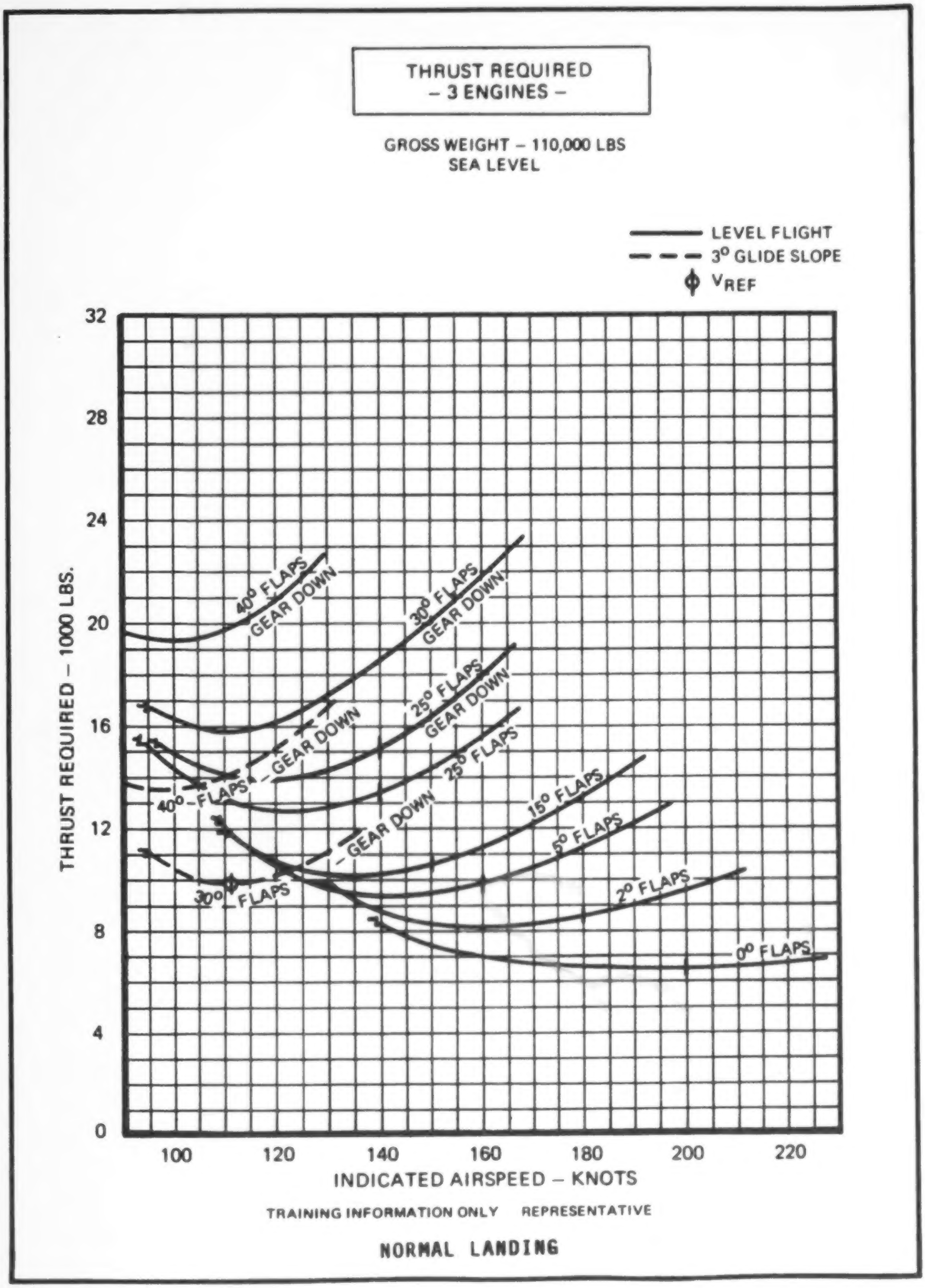


FIGURE 92.—Landing Thrust - 110,000 Pounds.

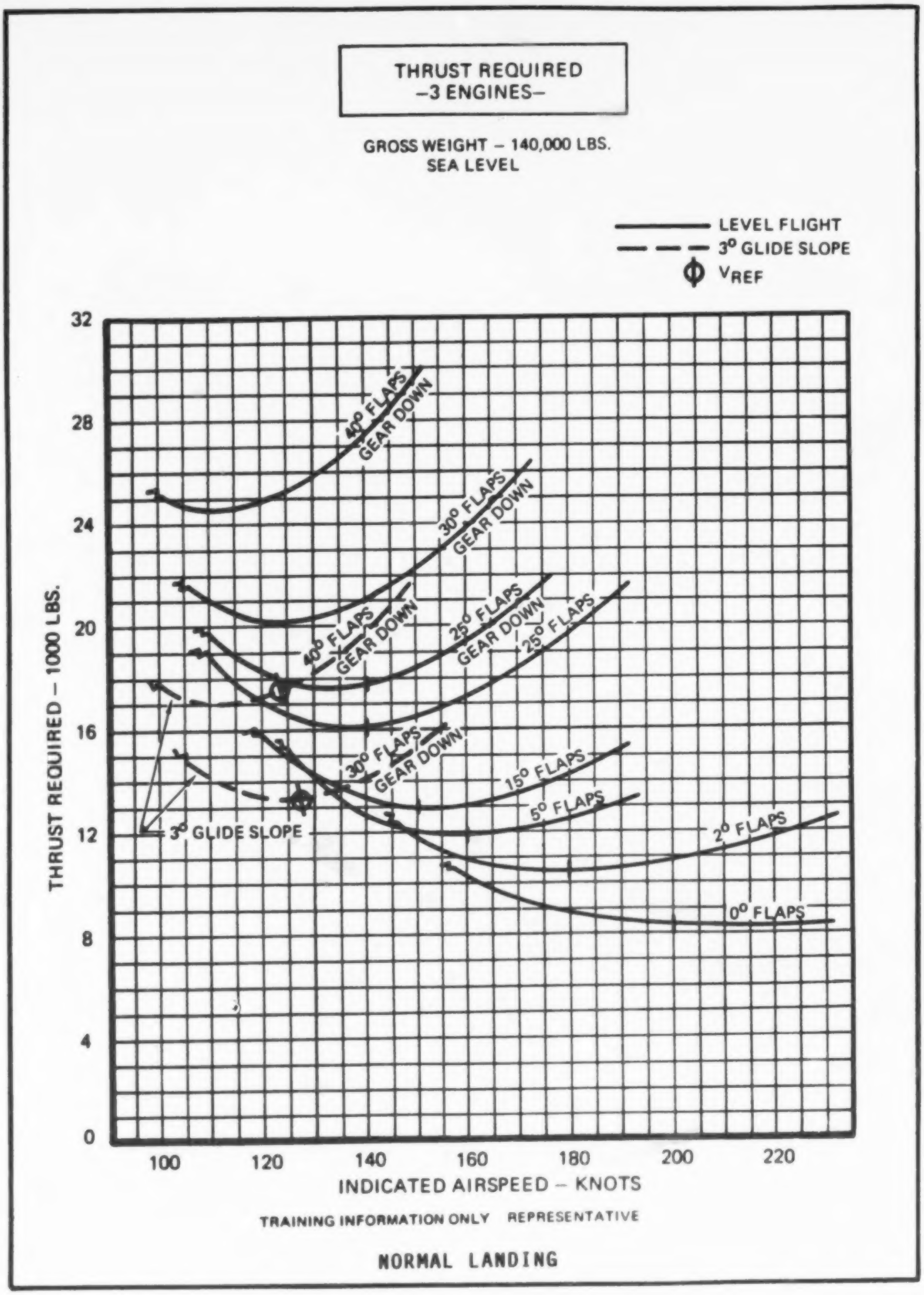


FIGURE 93.—Landing Thrust - 140,000 Pounds.

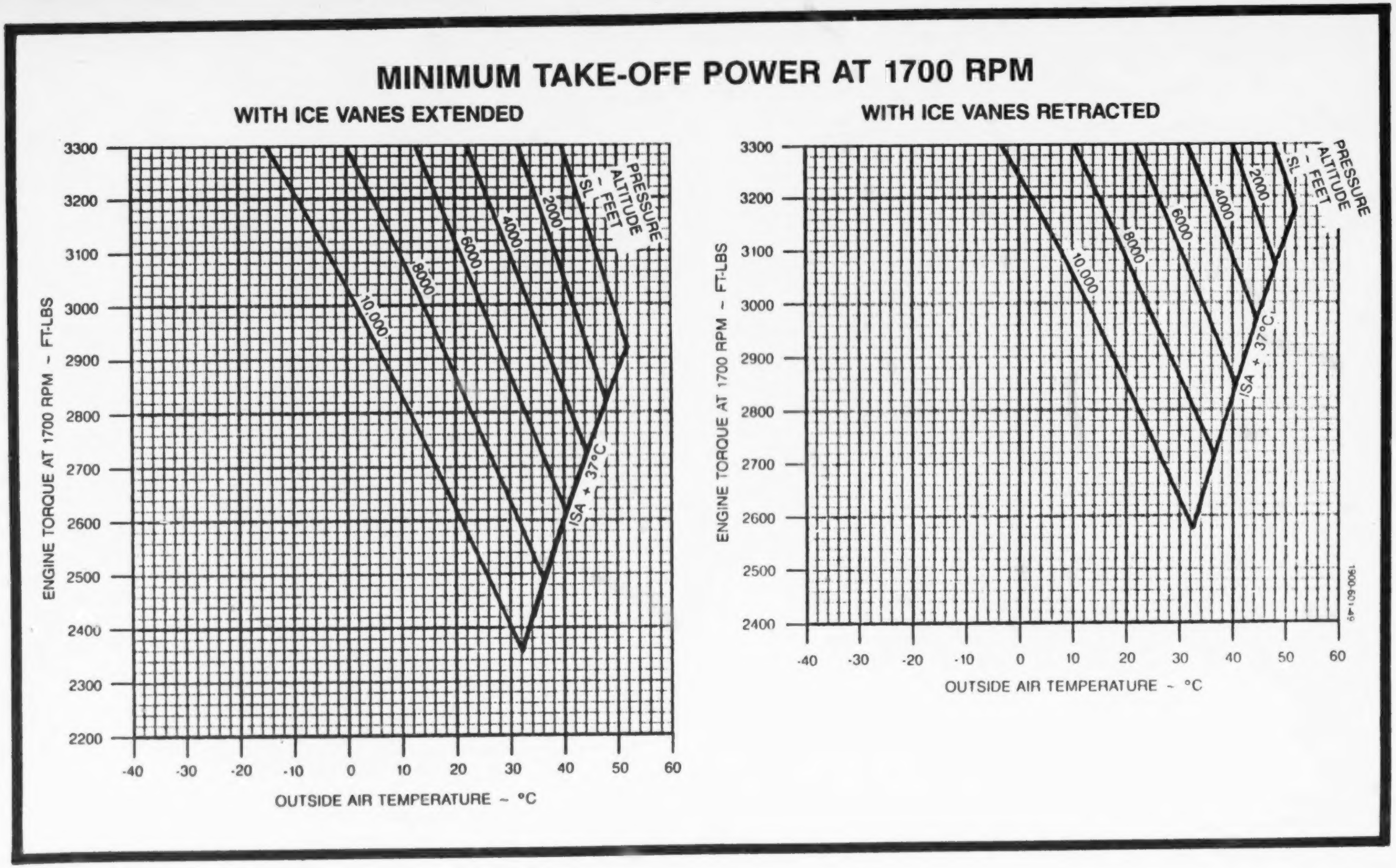


FIGURE 94.—Minimum Takeoff Power at 1700 RPM.

# TAKE-OFF DISTANCE — FLAPS TAKEOFF

ASSOCIATED CONDITIONS:

POWER .......... TAKE-OFF POWER SET BEFORE BRAKE RELEASE
LANDING GEAR ... RETRACT AFTER LIFT-OFF
RUNWAY ......... PAVED, LEVEL, DRY SURFACE

NOTE: FOR OPERATION WITH ICE VANES EXTENDED ADD 5°C TO THE ACTUAL OAT BEFORE ENTERING GRAPH.

| WEIGHT ~ POUNDS | TAKE-OFF SPEED ~ KNOTS | |
|---|---|---|
| | $V_1$ | $V_2$ |
| 16,600 | 108 | 115 |
| 16,000 | 107 | 114 |
| 14,000 | 102 | 112 |
| 12,000 | 102 | 112 |
| 10,000 | 102 | 112 |

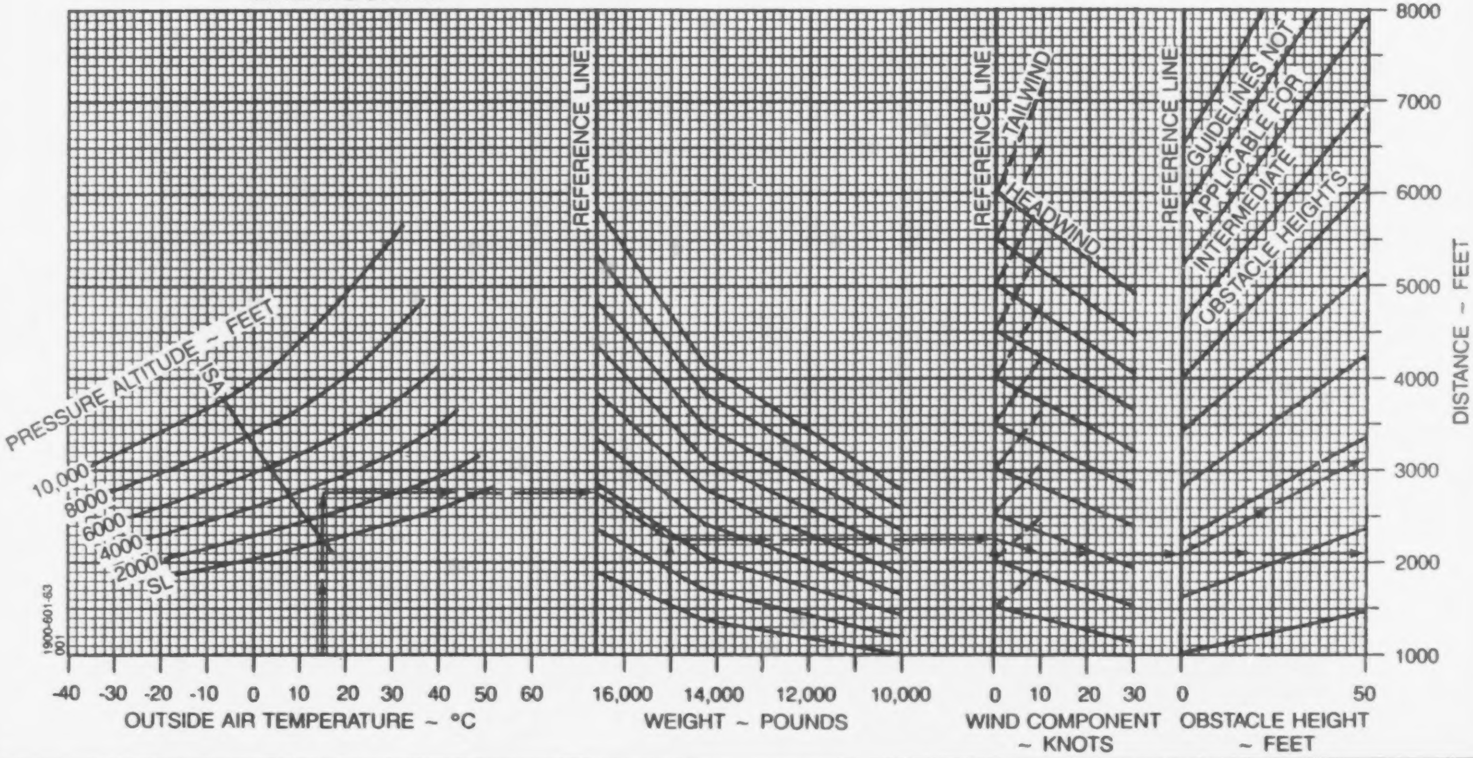


FIGURE 95.—Takeoff Distance - Flaps Takeoff.

# ACCELERATE-STOP — FLAPS TAKEOFF

ASSOCIATED CONDITIONS:

POWER .......... 1. TAKE-OFF POWER SET BEFORE BRAKE RELEASE
2. BOTH ENGINES IDLE AT $V_1$ SPEED
AUTOFEATHER ... ARMED
BRAKING ........ MAXIMUM
RUNWAY......... PAVED, LEVEL, DRY SURFACE

| WEIGHT ~ POUNDS | $V_1$ ~ KNOTS |
|---|---|
| 16,600 | 108 |
| 16,000 | 107 |
| 14,000 | 102 |
| 12,000 | 102 |
| 10,000 | 102 |

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, ADD 3°C TO THE ACTUAL OAT BEFORE ENTERING GRAPH.

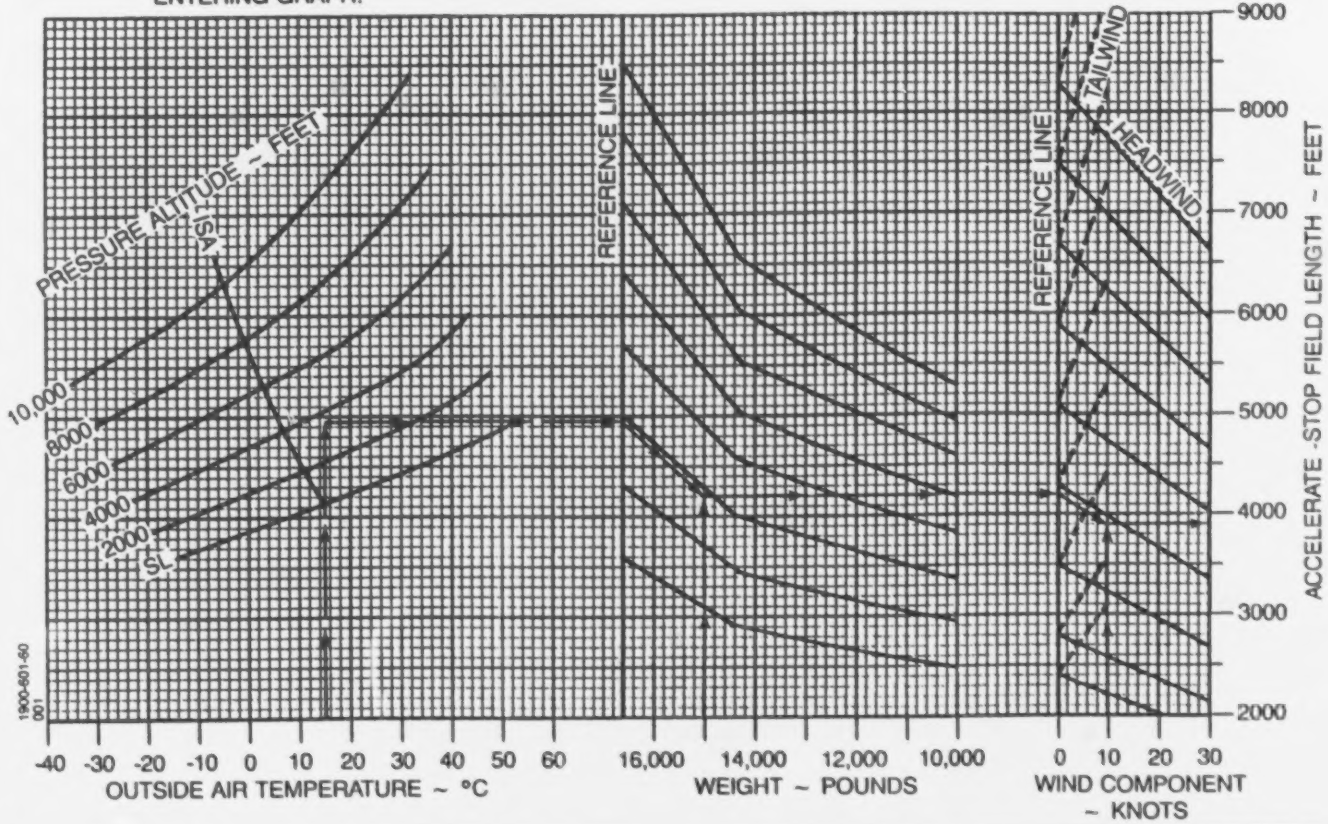


FIGURE 96.—Accelerate-Stop - Flaps Takeoff.

| OPERATING CONDITIONS | BE-21 | BE-22 | BE-23 | BE-24 | BE-25 |
|---|---|---|---|---|---|
| OAT AT TAKEOFF | +10° C | 0° C | +20° C | +25° C | -10° C |
| OAT AT CRUISE | -20° C | -25° C | ISA | 0° C | -40° C |
| AIRPORT PRESS ALTITUDE | 2,000 | 1,000 | 3,000 | 4,000 | 5,000 |
| CRUISE ALTITUDE | 16,000 | 18,000 | 20,000 | 14,000 | 22,000 |
| INITIAL CLIMB WEIGHT | 16,600 | 14,000 | 15,000 | 16,000 | 14,000 |
| ICE VANES | RETRACT | EXTEND | RETRACT | RETRACT | EXTEND |

FIGURE 97.—Beech 1900 Climb.

## CLIMB — TWO ENGINES — FLAPS UP

**ASSOCIATED CONDITIONS:**

POWER.......... MAXIMUM CONTINUOUS
FLAPS........... UP
LANDING GEAR... UP

| WEIGHT ~ POUNDS | CLIMB SPEED ~ KNOTS |
|---|---|
| 16,600 | 135 |
| 16,000 | 134 |
| 14,000 | 130 |
| 12,000 | 125 |
| 10,000 | 121 |

NOTE: DURING OPERATION WITH ICE VANES EXTENDED, RATE OF CLIMB WILL BE REDUCED APPROXIMATELY 240 FEET PER MINUTE.

**EXAMPLE:**

OAT.................... -4°C
PRESSURE ALTITUDE ... 9000 FT
WEIGHT ............... 14,500 LBS

RATE OF CLIMB......... 2490 FT/MIN
CLIMB GRADIENT ...... 14.7 %
CLIMB SPEED.......... 131 KTS

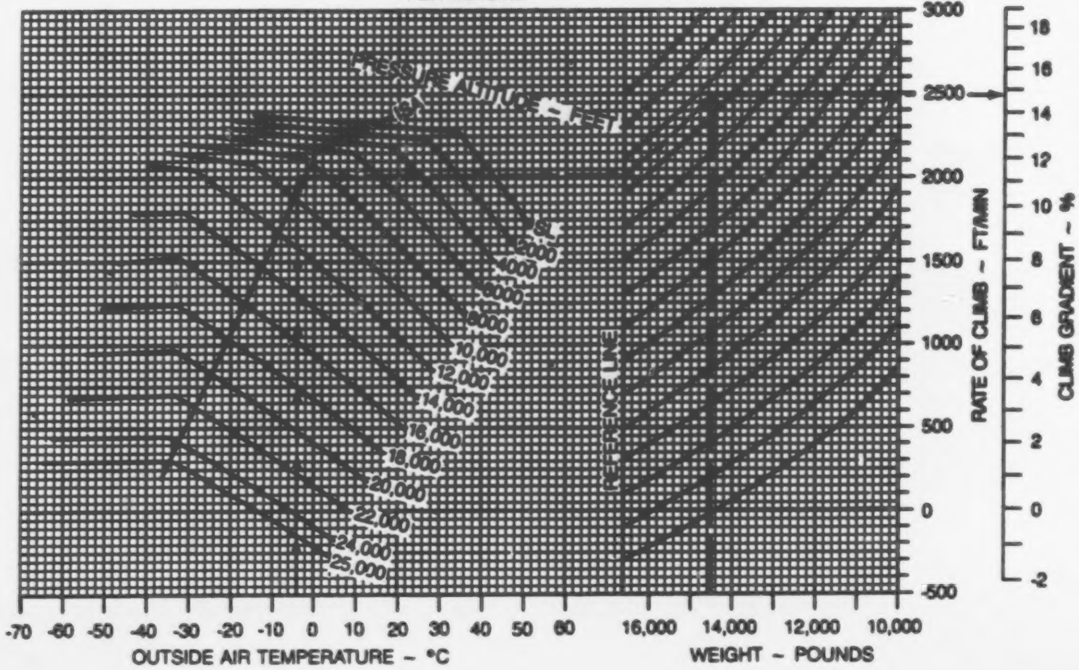


FIGURE 98.—Climb - Two Engines - Flaps Up.

# CLIMB — ONE ENGINE INOPERATIVE

**BLEED AIR ON**

ASSOCIATED CONDITIONS:

| | |
|---|---|
| POWER | MAXIMUM CONTINUOUS |
| FLAPS | UP |
| LANDING GEAR | UP |
| INOPERATIVE PROPELLER | FEATHERED |

| WEIGHT ~ POUNDS | CLIMB SPEED ~ KNOTS |
|---|---|
| 16,600 | 125 |
| 16,000 | 124 |
| 14,000 | 119 |
| 12,000 | 116 |
| 10,000 | 112 |

EXAMPLE:

| | |
|---|---|
| OAT | -4°C |
| PRESSURE ALTITUDE | 9000 FT |
| WEIGHT | 14,500 LBS |
| RATE OF CLIMB | 450 FT/MIN |
| CLIMB GRADIENT | 3.1 % |
| CLIMB SPEED | 120 KTS |

NOTE: DURING OPERATION WITH ICE VANES EXTENDED, RATE OF CLIMB WILL BE REDUCED APPROXIMATELY 115 FEET PER MINUTE.

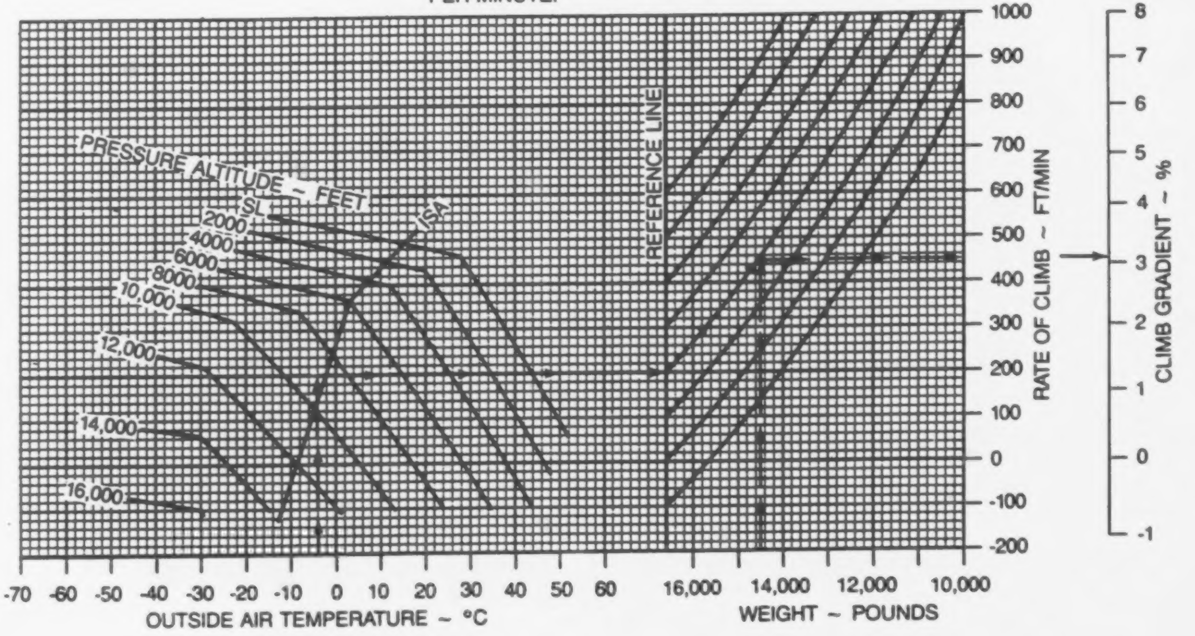


FIGURE 99.—Climb - One Engine Inoperative.

# TIME, FUEL, AND DISTANCE TO CRUISE CLIMB

**ASSOCIATED CONDITIONS:**

PROPELLER SPEED . . . 1550 RPM
POWER:
ITT . . . . . . . . . . . . . . . . 750°C
OR TORQUE . . . . . . . . 3400 FT-LBS

NOTES: 1. ADD 110 LBS FUEL FOR START, TAXI, AND TAKEOFF
2. FOR OPERATION WITH ICE VANES EXTENDED, ADD 10°C TO THE ACTUAL OAT BEFORE ENTERING THE GRAPH

| ALTITUDE ~ FEET | CLIMB SPEED ~ KNOTS |
|---|---|
| SL TO 10,000 | 160 |
| 10,000 TO 15,000 | 150 |
| 15,000 TO 20,000 | 140 |
| 20,000 TO 25,000 | 130 |

**EXAMPLE:**

| | |
|---|---|
| OAT AT TAKEOFF | 15°C |
| OAT AT CRUISE | -10°C |
| AIRPORT PRESSURE ALTITUDE | 3499 FT |
| CRUISE ALTITUDE | 11,000 FT |
| INITIAL CLIMB WEIGHT | 15,000 LBS |
| TIME TO CLIMB (5.8-1.8) | 4 MIN |
| FUEL TO CLIMB (103-35) | 68 LBS |
| DISTANCE TO CLIMB (16-5) | 11 NM |

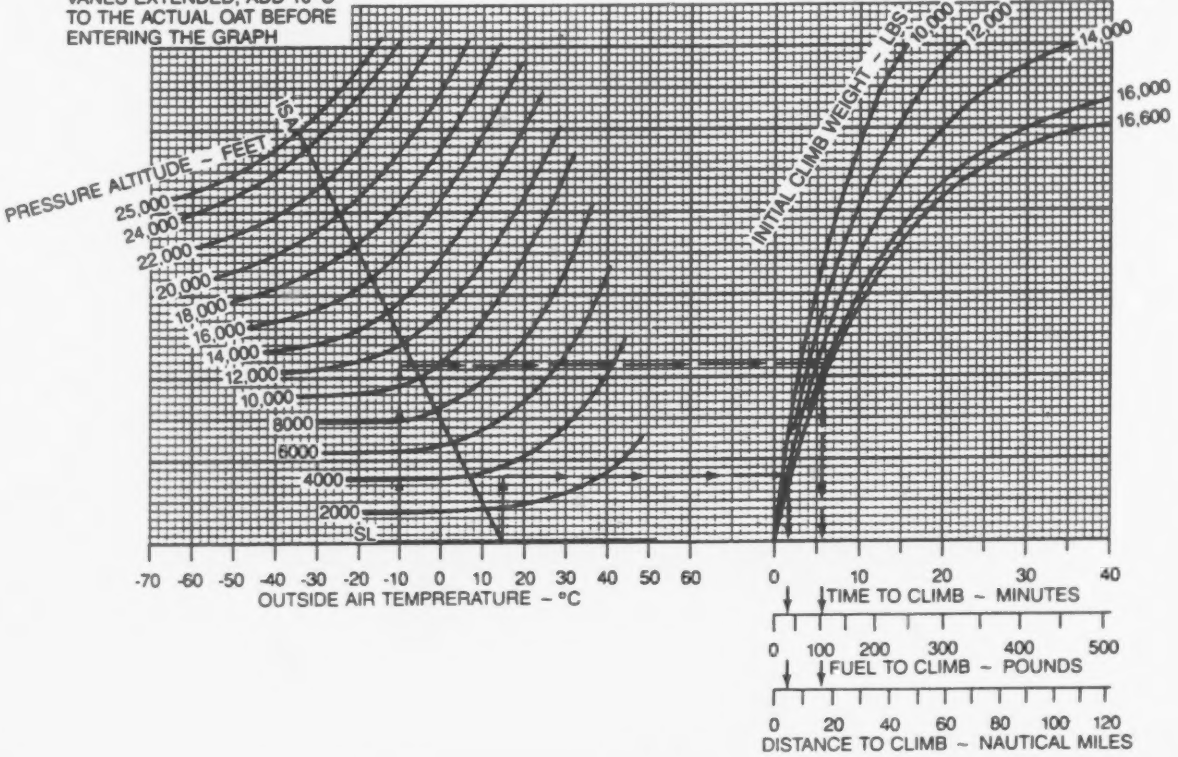


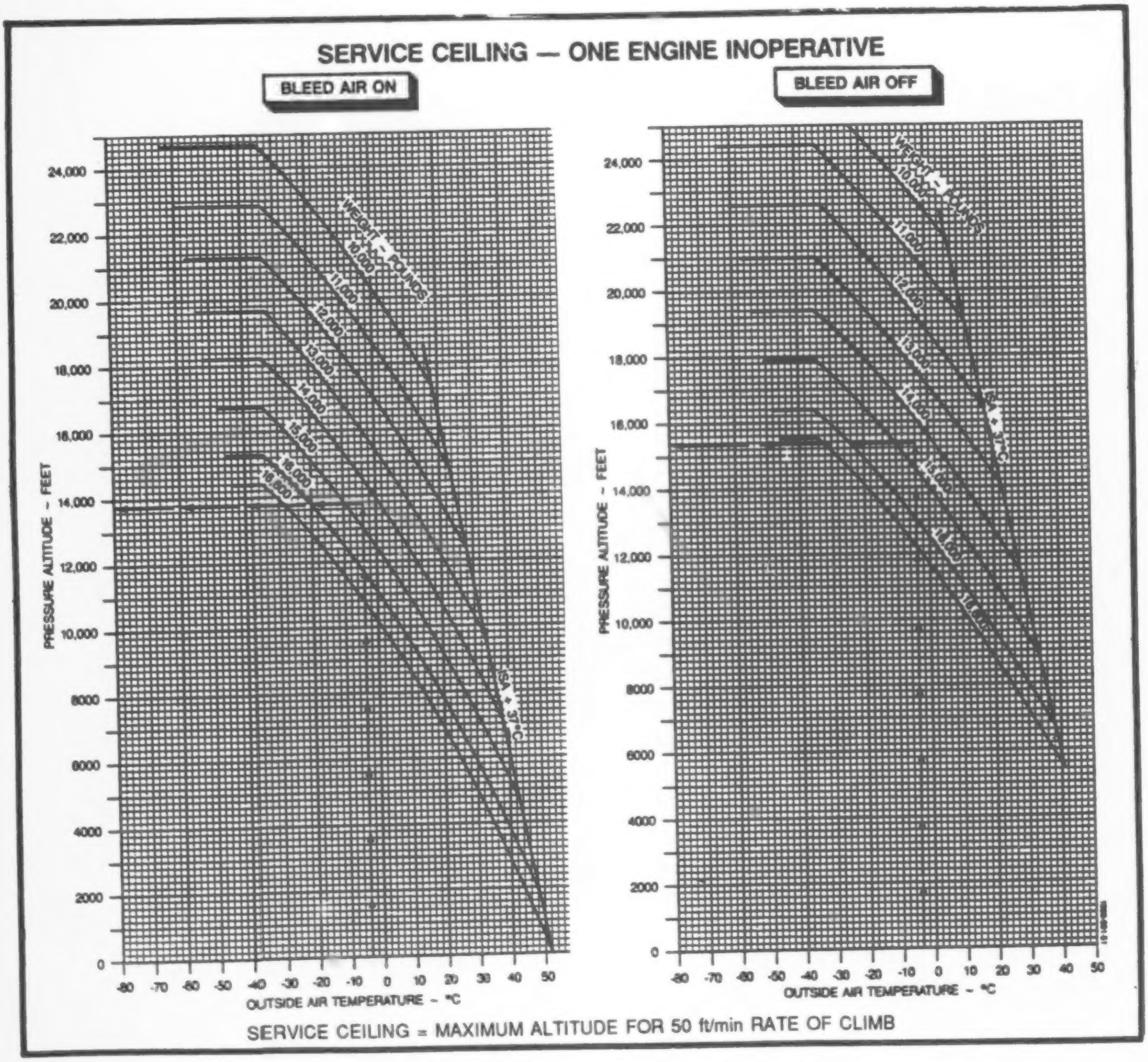
FIGURE 100.—Time, Fuel, and Distance to Cruise Climb.

| OPERATING CONDITIONS | BE-26 | BE-27 | BE-28 | BE-29 | BE-30 |
|---|---|---|---|---|---|
| OAT AT MEA | -8° C | +30° C | +5° C | +18° C | +22° C |
| WEIGHT | 15,500 | 16,600 | 16,000 | 16,300 | 14,500 |
| ROUTE SEGMENT MEA | 6,000 | 5,500 | 9,000 | 7,000 | 9,500 |
| BLEED AIR | ON | ON | OFF | ON | OFF |

FIGURE 101.—Beech 1900 Service Ceiling.

| OPERATING CONDITIONS | BE-31 | BE-32 | BE-33 | BE-34 | BE-35 |
|---|---|---|---|---|---|
| WEIGHT | 15,000 | 14,000 | 13,000 | 16,000 | 11,000 |
| PRESSURE ALTITUDE | 22,000 | 17,000 | 20,000 | 23,000 | 14,000 |
| TEMPERATURE (OAT) | -19° C | -19° C | -35° C | -31° C | -3° C |
| TRUE COURSE | 110 | 270 | 185 | 020 | 305 |
| WIND | 180/30 | 020/35 | 135/45 | 340/25 | 040/50 |
| CRUISE DISTANCE | 280 | 320 | 400 | 230 | 300 |

FIGURE 102.—Beech 1900 Cruise.



SERVICE CEILING = MAXIMUM ALTITUDE FOR 50 ft/min RATE OF CLIMB

FIGURE 103.—Service Ceiling - One Engine Inoperative.

# RECOMMENDED CRUISE POWER

## 1550 RPM

## ISA +10° C

| WEIGHT – | | | 16,000 POUNDS | | | | | 14,000 POUNDS | | | | | 12,000 POUNDS | | | | | 10,000 POUNDS | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PRESSURE ALTITUDE | IOAT | OAT | TORQUE PER ENG | FUEL FLOW PER ENG | TOTAL FUEL FLOW | IAS | TAS | TORQUE PER ENG | FUEL FLOW PER ENG | TOTAL FUEL FLOW | IAS | TAS | TORQUE PER ENG | FUEL FLOW PER ENG | TOTAL FUEL FLOW | IAS | TAS | TORQUE PER ENG | FUEL FLOW PER ENG | TOTAL FUEL FLOW | IAS | TAS |
| FEET | °C | °C | FT-LBS | LBS/HR | LBS/HR | KTS | KTS | FT-LBS | LBS/HR | LBS/HR | KTS | KTS | FT-LBS | LBS/HR | LBS/HR | KTS | KTS | FT-LBS | LBS/HR | LBS/HR | KTS | KTS |
| SL | 30 | 25 | 3294 | 577 | 1154 | 232 | 239 | 3301 | 577 | 1154 | 235 | 241 | 3307 | 577 | 1154 | 237 | 243 | 3312 | 577 | 1154 | 238 | 245 |
| 2000 | 26 | 21 | 3191 | 551 | 1102 | 227 | 240 | 3198 | 551 | 1102 | 230 | 243 | 3204 | 552 | 1104 | 232 | 245 | 3209 | 552 | 1104 | 233 | 247 |
| 4000 | 22 | 17 | 3092 | 527 | 1054 | 222 | 242 | 3100 | 528 | 1056 | 224 | 244 | 3106 | 528 | 1056 | 227 | 247 | 3111 | 528 | 1056 | 228 | 249 |
| 6000 | 19 | 13 | 2992 | 504 | 1008 | 216 | 243 | 3000 | 505 | 1010 | 219 | 246 | 3006 | 505 | 1010 | 222 | 249 | 3012 | 505 | 1010 | 224 | 251 |
| 8000 | 15 | 9 | 2886 | 481 | 962 | 211 | 244 | 2896 | 482 | 964 | 214 | 247 | 2903 | 482 | 964 | 216 | 250 | 2909 | 482 | 964 | 219 | 253 |
| 10,000 | 11 | 5 | 2778 | 458 | 916 | 205 | 244 | 2789 | 458 | 916 | 208 | 248 | 2797 | 459 | 918 | 211 | 252 | 2804 | 459 | 918 | 213 | 254 |
| 12,000 | 7 | 1 | 2636 | 432 | 864 | 198 | 243 | 2648 | 433 | 866 | 202 | 248 | 2657 | 433 | 866 | 205 | 252 | 2664 | 434 | 868 | 207 | 255 |
| 14,000 | 3 | -3 | 2495 | 408 | 816 | 190 | 241 | 2508 | 409 | 818 | 195 | 247 | 2518 | 409 | 818 | 198 | 251 | 2525 | 409 | 818 | 201 | 255 |
| 16,000 | -1 | -7 | 2352 | 384 | 768 | 182 | 239 | 2367 | 385 | 770 | 188 | 246 | 2378 | 385 | 770 | 192 | 251 | 2386 | 386 | 772 | 195 | 255 |
| 18,000 | -6 | -11 | 2208 | 361 | 722 | 174 | 235 | 2226 | 362 | 724 | 180 | 243 | 2239 | 363 | 726 | 185 | 250 | 2248 | 363 | 726 | 188 | 254 |
| 20,000 | -10 | -15 | 2063 | 338 | 676 | 164 | 229 | 2085 | 340 | 680 | 172 | 240 | 2100 | 341 | 682 | 177 | 248 | 2111 | 341 | 682 | 181 | 253 |
| 22,000 | -14 | -19 | 1911 | 316 | 632 | 153 | 221 | 1939 | 317 | 634 | 163 | 235 | 1957 | 319 | 638 | 169 | 245 | 1969 | 319 | 638 | 174 | 252 |
| 24,000 | -19 | -23 | 1749 | 292 | 584 | 137 | 206 | 1790 | 295 | 590 | 152 | 229 | 1812 | 297 | 594 | 161 | 241 | 1827 | 298 | 596 | 167 | 249 |
| 25,000 | -21 | -25 | 1649 | 279 | 558 | 122 | 187 | 1714 | 284 | 568 | 147 | 224 | 1739 | 286 | 572 | 156 | 238 | 1756 | 287 | 574 | 163 | 248 |

FIGURE 104.—Recommended Cruise Power - ISA +10° C.

# RECOMMENDED CRUISE POWER

## 1550 RPM

## ISA

| WEIGHT – | | | 16,000 POUNDS | | | | | 14,000 POUNDS | | | | | 12,000 POUNDS | | | | | 10,000 POUNDS | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PRESSURE ALTITUDE | IOAT | OAT | TORQUE PER ENG | FUEL FLOW PER ENG | TOTAL FUEL FLOW | IAS | TAS | TORQUE PER ENG | FUEL FLOW PER ENG | TOTAL FUEL FLOW | IAS | TAS | TORQUE PER ENG | FUEL FLOW PER ENG | TOTAL FUEL FLOW | IAS | TAS | TORQUE PER ENG | FUEL FLOW PER ENG | TOTAL FUEL FLOW | IAS | TAS |
| FEET | °C | °C | FT-LBS | LBS/HR | LBS/HR | KTS | KTS | FT-LBS | LBS/HR | LBS/HR | KTS | KTS | FT-LBS | LBS/HR | LBS/HR | KTS | KTS | FT-LBS | LBS/HR | LBS/HR | KTS | KTS |
| SL | 20 | 15 | 3400 | 586 | 1172 | 237 | 239 | 3400 | 585 | 1170 | 239 | 241 | 3400 | 585 | 1170 | 241 | 243 | 3400 | 585 | 1170 | 242 | 244 |
| 2000 | 17 | 11 | 3400 | 573 | 1146 | 234 | 244 | 3400 | 573 | 1146 | 236 | 246 | 3400 | 572 | 1144 | 238 | 248 | 3400 | 572 | 1144 | 240 | 249 |
| 4000 | 13 | 7 | 3400 | 560 | 1120 | 232 | 248 | 3400 | 559 | 1118 | 234 | 250 | 3400 | 559 | 1118 | 236 | 252 | 3400 | 559 | 1118 | 237 | 254 |
| 6000 | 9 | 3 | 3397 | 548 | 1096 | 229 | 252 | 3400 | 548 | 1096 | 231 | 255 | 3400 | 547 | 1094 | 233 | 257 | 3400 | 547 | 1094 | 235 | 259 |
| 8000 | 5 | -1 | 3253 | 521 | 1042 | 223 | 253 | 3260 | 522 | 1044 | 225 | 256 | 3265 | 522 | 1044 | 228 | 258 | 3270 | 522 | 1044 | 229 | 260 |
| 10,000 | 1 | -5 | 3092 | 494 | 988 | 216 | 252 | 3100 | 494 | 988 | 219 | 256 | 3107 | 495 | 990 | 221 | 258 | 3112 | 495 | 990 | 223 | 261 |
| 12,000 | -3 | -9 | 2929 | 466 | 932 | 208 | 251 | 2937 | 467 | 934 | 212 | 255 | 2945 | 467 | 934 | 214 | 258 | 2950 | 467 | 934 | 217 | 261 |
| 14,000 | -7 | -13 | 2772 | 440 | 880 | 201 | 250 | 2781 | 441 | 882 | 205 | 255 | 2789 | 441 | 882 | 208 | 258 | 2795 | 442 | 884 | 210 | 261 |
| 16,000 | -11 | -17 | 2606 | 414 | 828 | 193 | 248 | 2618 | 414 | 828 | 197 | 253 | 2626 | 415 | 830 | 201 | 258 | 2633 | 415 | 830 | 203 | 261 |
| 18,000 | -15 | -21 | 2435 | 388 | 776 | 184 | 244 | 2449 | 389 | 778 | 189 | 251 | 2459 | 389 | 778 | 193 | 256 | 2467 | 390 | 780 | 196 | 260 |
| 20,000 | -19 | -25 | 2263 | 363 | 726 | 175 | 239 | 2282 | 364 | 728 | 181 | 248 | 2294 | 365 | 730 | 186 | 254 | 2302 | 365 | 730 | 189 | 259 |
| 22,000 | -24 | -29 | 2094 | 338 | 676 | 164 | 233 | 2118 | 340 | 680 | 172 | 244 | 2133 | 341 | 682 | 178 | 251 | 2144 | 342 | 684 | 182 | 257 |
| 24,000 | -28 | -33 | 1931 | 315 | 630 | 152 | 223 | 1960 | 317 | 634 | 163 | 238 | 1979 | 318 | 636 | 169 | 248 | 1991 | 319 | 638 | 174 | 255 |
| 25,000 | -30 | -35 | 1846 | 303 | 606 | 145 | 216 | 1880 | 305 | 610 | 157 | 235 | 1901 | 307 | 614 | 165 | 246 | 1915 | 308 | 616 | 170 | 253 |

FIGURE 105.—Recommended Cruise Power - ISA.

# RECOMMENDED CRUISE POWER

## 1550 RPM

## ISA -10° C

| WEIGHT – | | | 16,000 POUNDS | | | | | 14,000 POUNDS | | | | | 12,000 POUNDS | | | | | 10,000 POUNDS | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PRESSURE-ALTITUDE | IOAT | OAT | TORQUE PER ENG | FUEL FLOW PER ENG | TOTAL FUEL FLOW | IAS | TAS | TORQUE PER ENG | FUEL FLOW PER ENG | TOTAL FUEL FLOW | IAS | TAS | TORQUE PER ENG | FUEL FLOW PER ENG | TOTAL FUEL FLOW | IAS | TAS | TORQUE PER ENG | FUEL FLOW PER ENG | TOTAL FUEL FLOW | IAS | TAS |
| FEET | °C | °C | FT-LBS | LBS/HR | LBS/HR | KTS | KTS | FT-LBS | LBS/HR | LBS/HR | KTS | KTS | FT-LBS | LBS/HR | LBS/HR | KTS | KTS | FT-LBS | LBS/HR | LBS/HR | KTS | KTS |
| SL | 10 | 5 | 3400 | 582 | 1164 | 238 | 237 | 3400 | 582 | 1164 | 240 | 239 | 3400 | 581 | 1162 | 242 | 240 | 3400 | 581 | 1162 | 243 | 242 |
| 2000 | 6 | 1 | 3400 | 569 | 1138 | 236 | 241 | 3400 | 569 | 1138 | 238 | 243 | 3400 | 568 | 1136 | 240 | 245 | 3400 | 568 | 1136 | 241 | 246 |
| 4000 | 3 | -3 | 3400 | 558 | 1116 | 233 | 245 | 3400 | 557 | 1114 | 236 | 248 | 3400 | 557 | 1114 | 237 | 249 | 3400 | 557 | 1114 | 239 | 251 |
| 6000 | -1 | -7 | 3400 | 548 | 1096 | 231 | 250 | 3400 | 547 | 1094 | 233 | 252 | 3400 | 547 | 1094 | 235 | 254 | 3400 | 546 | 1092 | 236 | 256 |
| 8000 | -5 | -11 | 3400 | 538 | 1076 | 228 | 254 | 3400 | 538 | 1076 | 231 | 257 | 3400 | 538 | 1076 | 232 | 259 | 3400 | 537 | 1074 | 234 | 261 |
| 10,000 | -9 | -15 | 3400 | 530 | 1060 | 226 | 259 | 3400 | 530 | 1060 | 228 | 262 | 3400 | 530 | 1060 | 230 | 264 | 3400 | 529 | 1058 | 232 | 266 |
| 12,000 | -13 | -19 | 3200 | 499 | 998 | 218 | 258 | 3208 | 500 | 1000 | 221 | 261 | 3215 | 500 | 1000 | 223 | 264 | 3220 | 501 | 1002 | 225 | 266 |
| 14,000 | -17 | -23 | 3010 | 470 | 940 | 210 | 256 | 3019 | 471 | 942 | 213 | 260 | 3026 | 471 | 942 | 216 | 263 | 3032 | 472 | 944 | 218 | 266 |
| 16,000 | -21 | -27 | 2823 | 442 | 884 | 202 | 254 | 2833 | 442 | 884 | 205 | 258 | 2841 | 443 | 886 | 209 | 262 | 2848 | 443 | 886 | 211 | 265 |
| 18,000 | -25 | -31 | 2641 | 414 | 828 | 193 | 251 | 2652 | 415 | 830 | 198 | 256 | 2661 | 416 | 832 | 201 | 261 | 2668 | 416 | 832 | 204 | 264 |
| 20,000 | -29 | -35 | 2456 | 387 | 774 | 184 | 247 | 2471 | 388 | 776 | 189 | 254 | 2481 | 389 | 778 | 193 | 259 | 2489 | 390 | 780 | 196 | 263 |
| 22,000 | -33 | -39 | 2277 | 361 | 722 | 174 | 242 | 2296 | 363 | 726 | 181 | 250 | 2308 | 363 | 726 | 185 | 256 | 2318 | 364 | 728 | 189 | 261 |
| 24,000 | -37 | -43 | 2105 | 336 | 672 | 163 | 234 | 2128 | 338 | 676 | 172 | 246 | 2144 | 339 | 678 | 177 | 254 | 2155 | 340 | 680 | 181 | 260 |
| 25,000 | -40 | -45 | 2017 | 324 | 648 | 157 | 230 | 2044 | 326 | 652 | 167 | 243 | 2061 | 327 | 654 | 173 | 252 | 2073 | 328 | 656 | 177 | 258 |

FIGURE 106.—Recommended Cruise Power - ISA -10° C.

## TIME, FUEL, AND DISTANCE TO DESCEND

### AT 200 KNOTS

**ASSOCIATED CONDITIONS:**

POWER .......... AS REQUIRED TO DESCEND AT 1500 FT/MIN
LANDING GEAR ... UP
FLAPS ........... UP

**EXAMPLE:**

INITIAL ALTITUDE ................ 11,000 FT
FINAL ALTITUDE ................. 5998 FT

TIME TO DESCEND (7.4-4.1) ...... 3.3 MIN
FUEL TO DESCEND (74-41) ....... 33 LBS
DISTANCE TO DESCEND (26-13) ... 13 NM

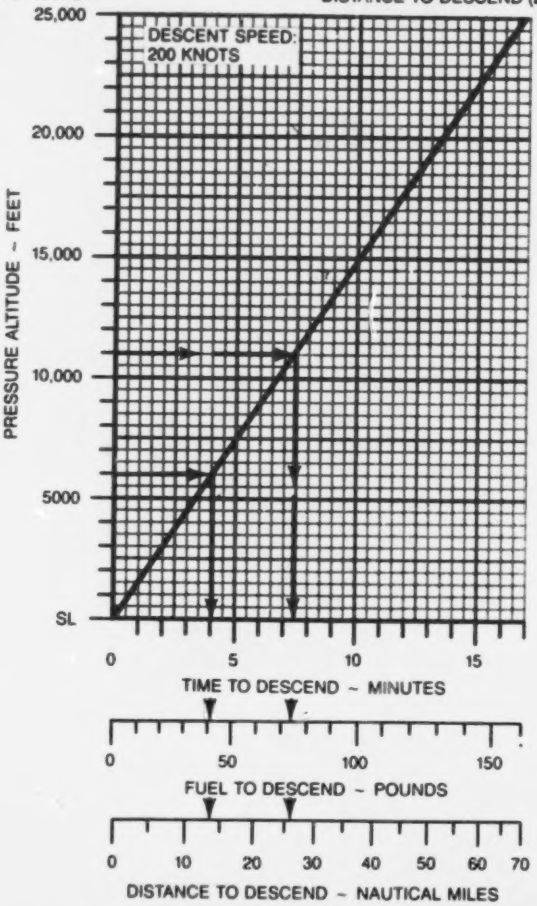


FIGURE 107.—Time, Fuel, and Distance to Descend.

| OPERATING CONDITIONS | B-36 | B-37 | B-38 | B-39 | B-40 |
|---|---|---|---|---|---|
| PRESSURE ALTITUDE | SL | 1,000 | 2,000 | 4,000 | 5,000 |
| TEMPERATURE (OAT) | +30° C | +16° C | 0° C | +20° C | ISA |
| WEIGHT | 16,000 | 14,500 | 13,500 | 15,000 | 12,500 |
| WIND COMPONENT (KTS) | 20 HW | 10 TW | 15 HW | 5 TW | 25 HW |
| RUNWAY LENGTH (FT) | 4,000 | 4,500 | 3,800 | 5,000 | 4,000 |

FIGURE 108.—Beech 1900 Landing.

# NORMAL LANDING DISTANCE — FLAPS LANDING

## ANTI-SKID ON

**ASSOCIATED CONDITIONS:**

| | |
|---|---|
| POWER | RETARD TO MAINTAIN 800 FT/MIN ON FINAL APPROACH |
| RUNWAY | PAVED, LEVEL, DRY SURFACE |
| APPROACH SPEED | IAS AS TABULATED |
| BRAKING | MAXIMUM |

| WEIGHT ~ POUNDS | APPROACH SPEED ~ KNOTS |
|---|---|
| 16,100 | 113 |
| 14,000 | 107 |
| 12,000 | 101 |
| 10,000 | 93 |

**EXAMPLE:**

| | |
|---|---|
| OAT | 25°C |
| PRESSURE ALTITUDE | 5996 FT |
| LANDING WEIGHT | 14,182 LBS |
| HEADWIND COMPONENT | 10 KTS |
| GROUND ROLL | 1150 FT |
| TOTAL OVER 50-FT OBSTACLE | 2195 FT |
| APPROACH SPEED | 108 KTS |

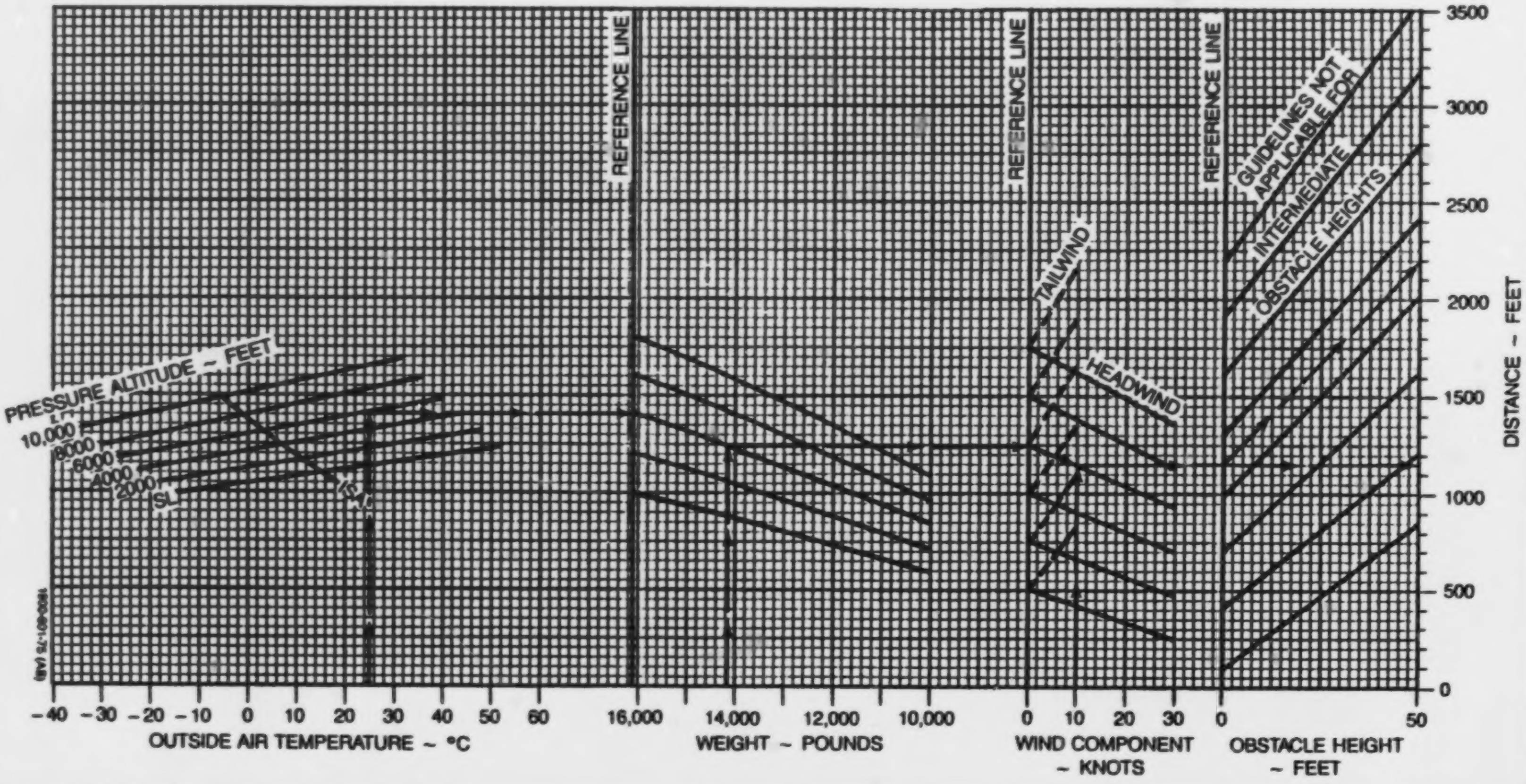


FIGURE 109.—Normal Landing Distance - Flaps Landing.

## MODEL 214ST
## POWER ASSURANCE CHECK
## GROUND OPERATION
### GENERAL ELECTRIC CT-7-2A ENGINE

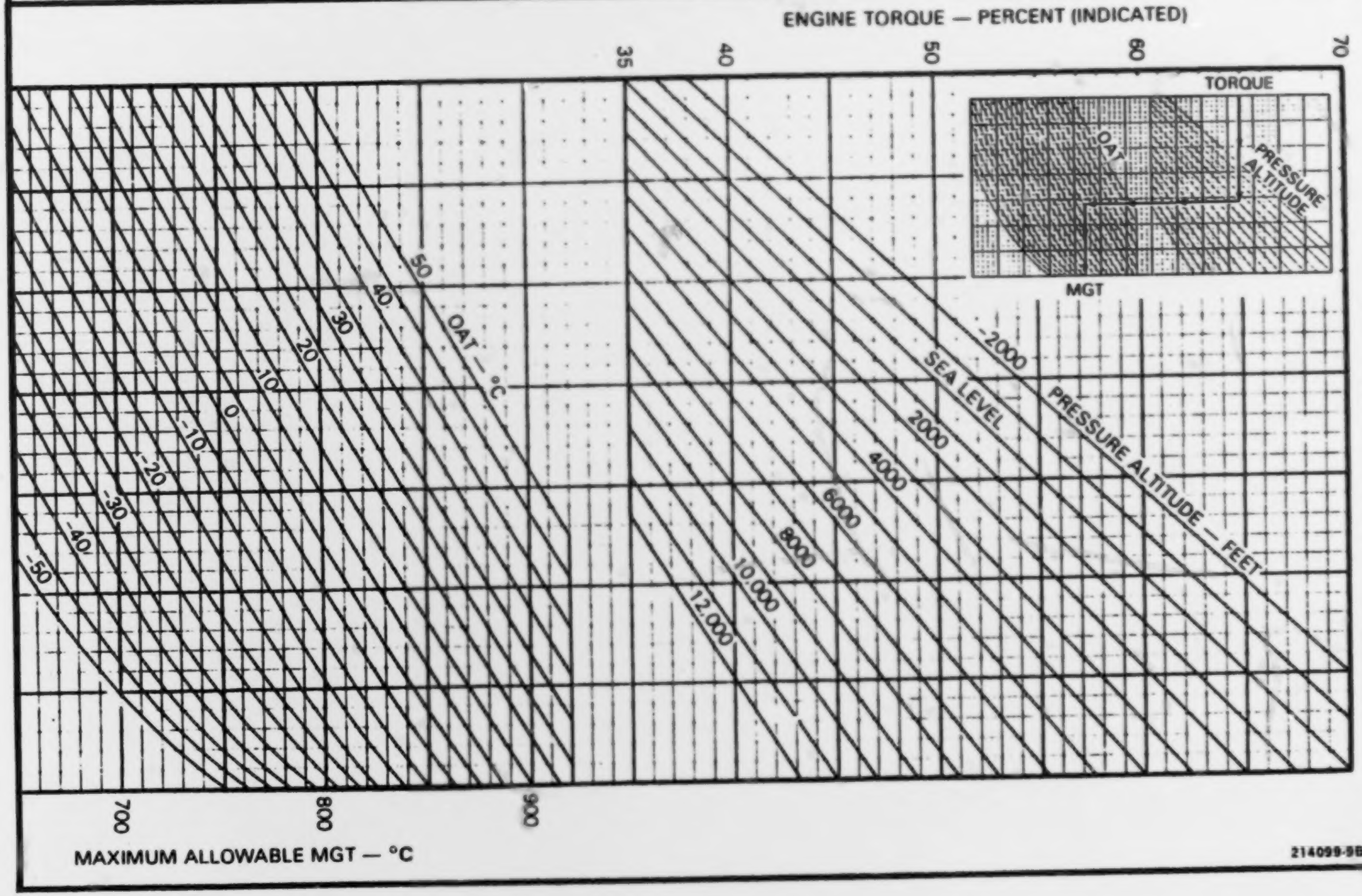


FIGURE 110.—Power Assurance Check.

## HOVER CEILING — IN GROUND EFFECT

0° TO 52°C

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATOR 400 AMPS

SKID HEIGHT 5 FEET
HEATER OFF
ENGINE AND ENGINE INLET ANTI-ICE OFF

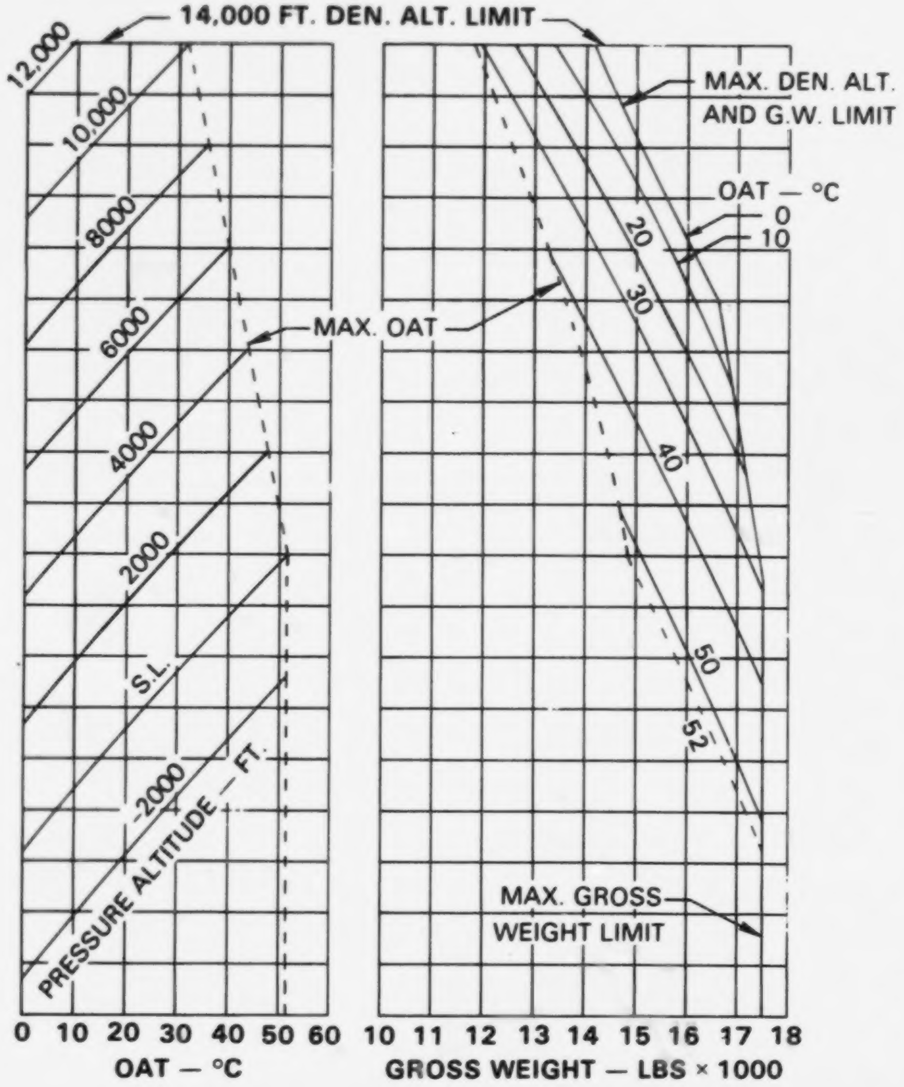


FIGURE 111.—Hovering Ceiling - In Ground Effect.

## HOVER CEILING — OUT OF GROUND EFFECT

0° TO 52°C

MAXIMUM CONTINUOUS POWER
SKID HEIGHT 100 FEET
ENGINE RPM 100%
HEATER OFF
GENERATOR 400 AMPS
ENGINE AND ENGINE INLET ANTI-ICE OFF

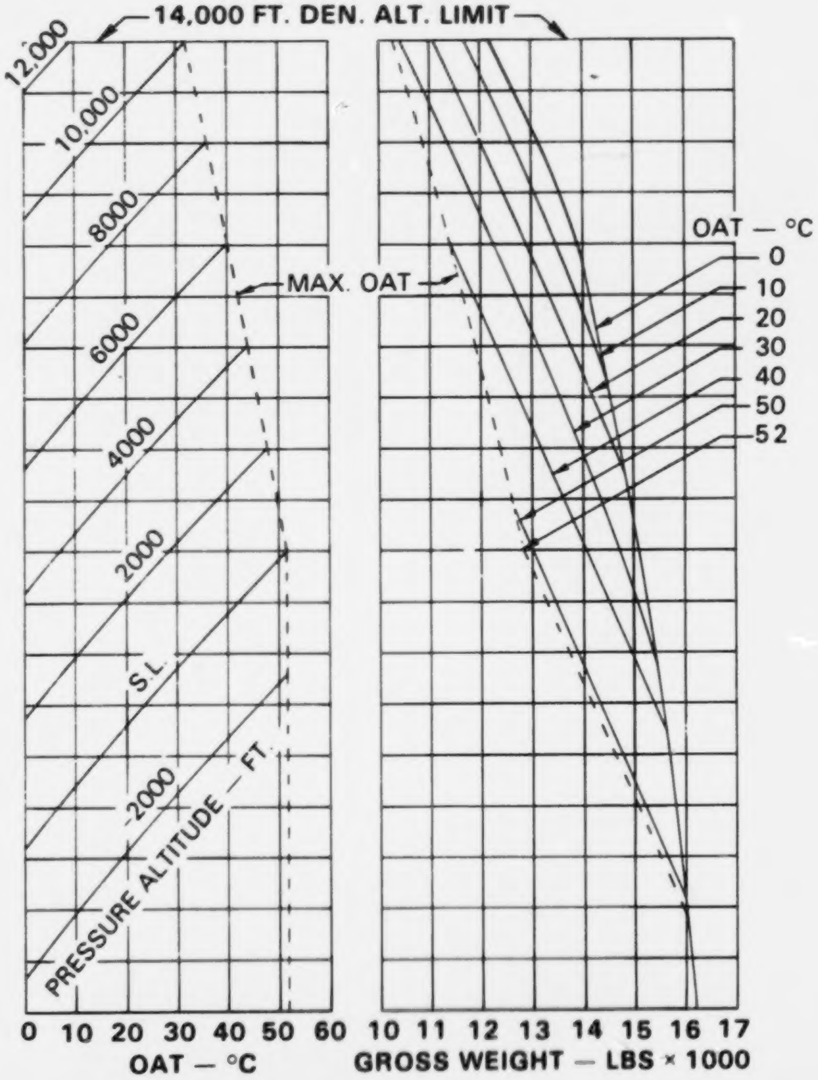


FIGURE 112.—Hovering Ceiling - Out of Ground Effect.

**TAKE-OFF DISTANCE OVER 50 FOOT OBSTACLE**

52° TO - 35°C
HOVER POWER + 10% TORQUE
ENGINE RPM 100%
GENERATOR 400 AMPS

INITIATED FROM 5 FT. SKID HEIGHT
VTOCS = 50 KIAS
HEATER ON OR OFF
ENGINE AND ENGINE INLET ANTI-ICE OFF

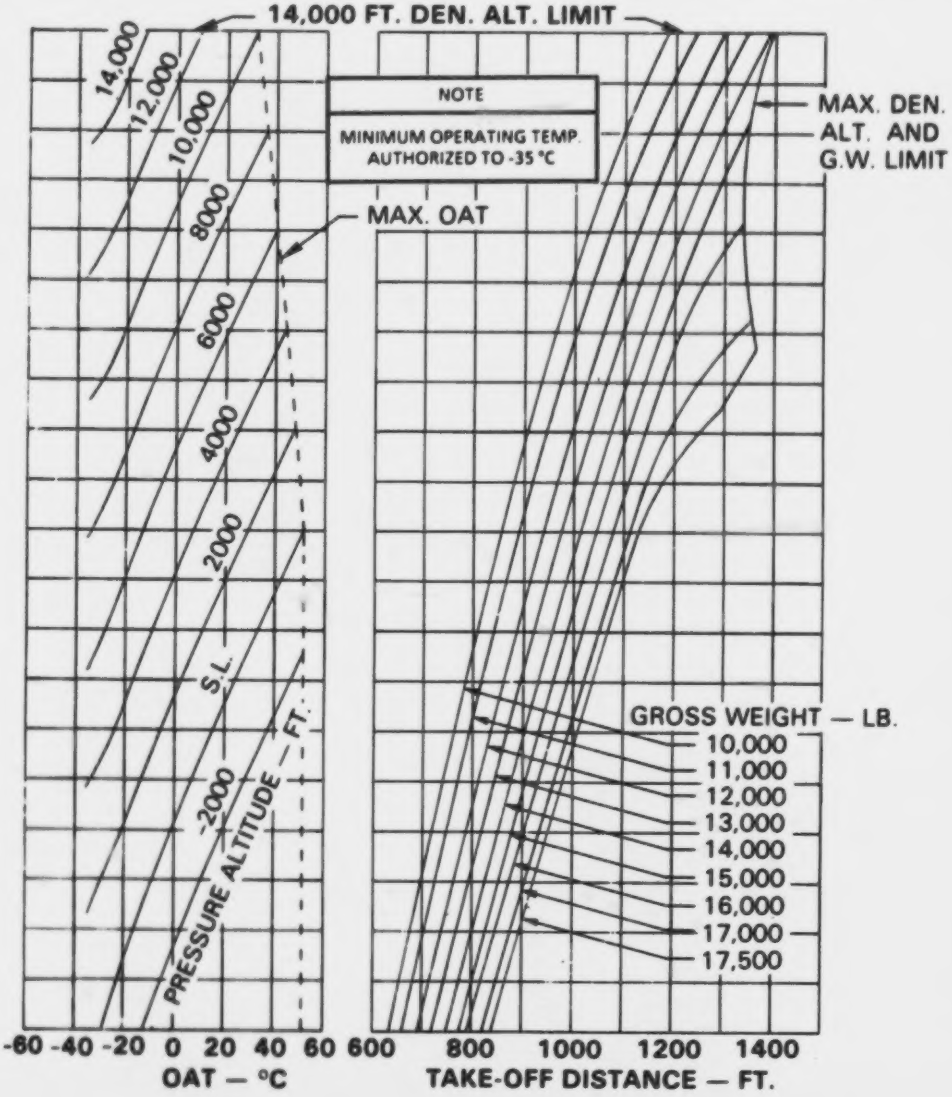
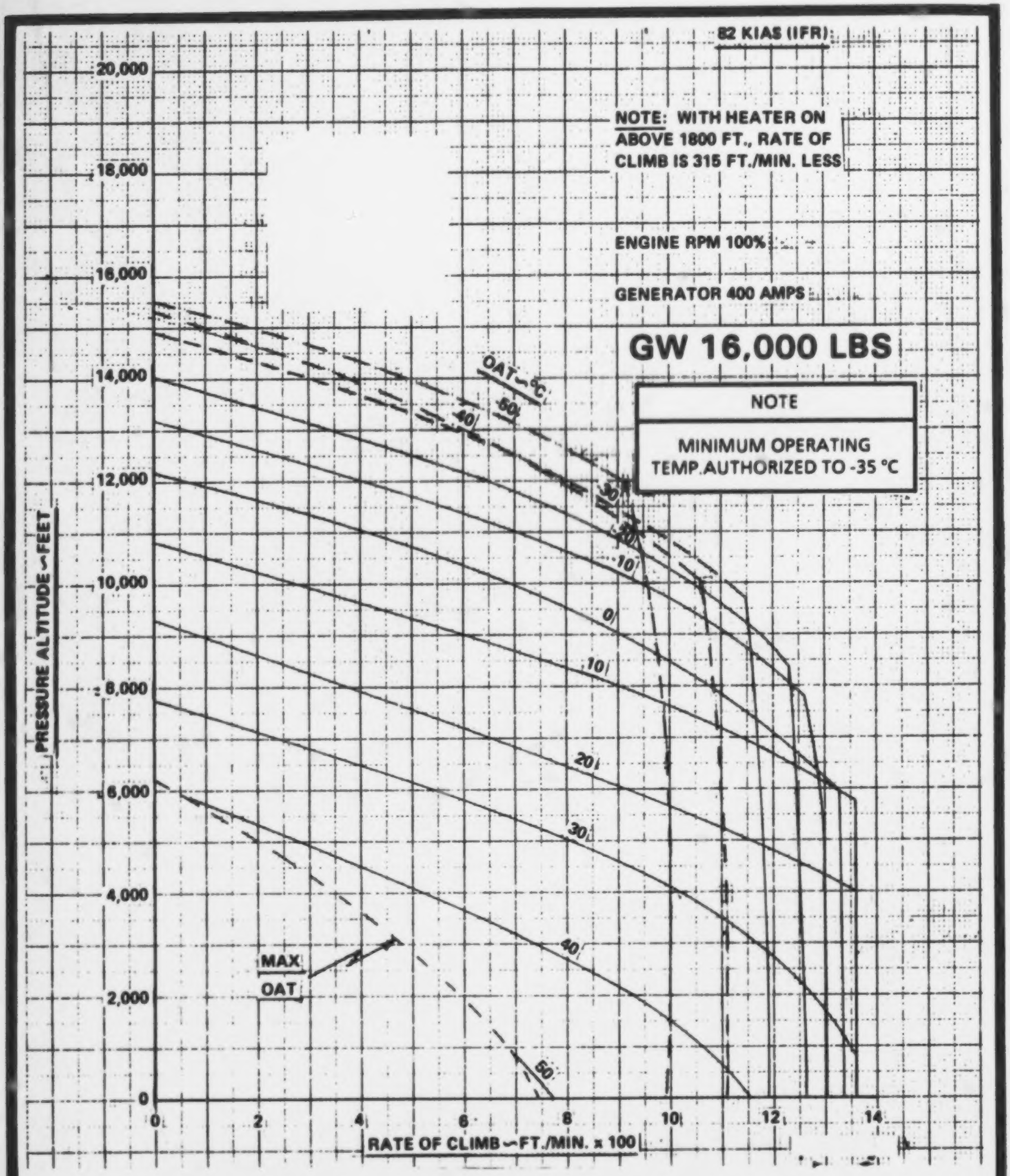
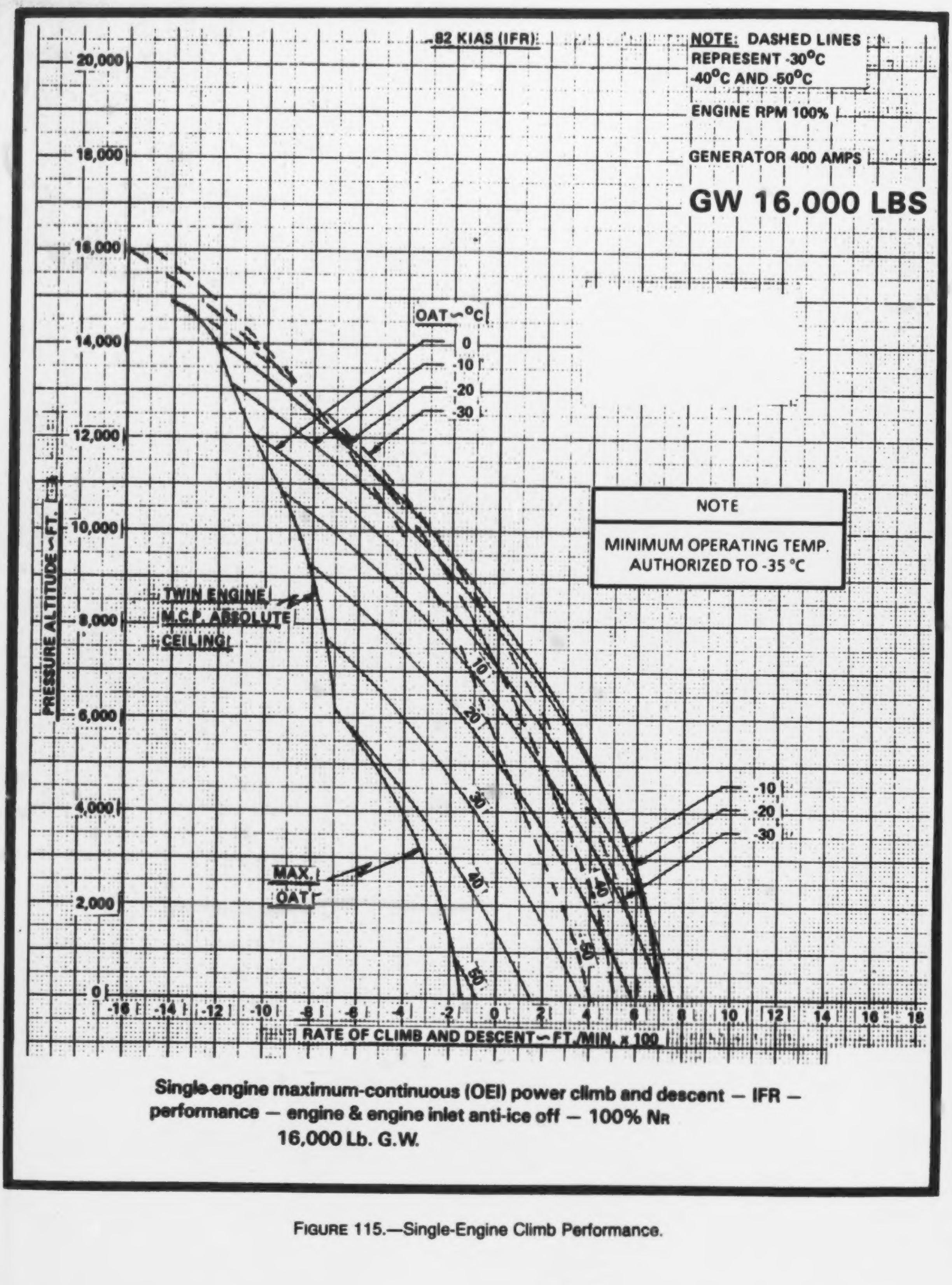


FIGURE 113.—Takeoff Distance Over 50-Foot Obstacle.



**Twin engine maximum continuous power climb performance — IFR — engine & engine inlet anti-ice off — heater off — 100% $N_R$**
**16,000 Lb. G.W.**

FIGURE 114.—Twin-Engine Climb Performance.



Single-engine maximum-continuous (OEI) power climb and descent — IFR — performance — engine & engine inlet anti-ice off — 100% NR
16,000 Lb. G.W.

FIGURE 115.—Single-Engine Climb Performance.

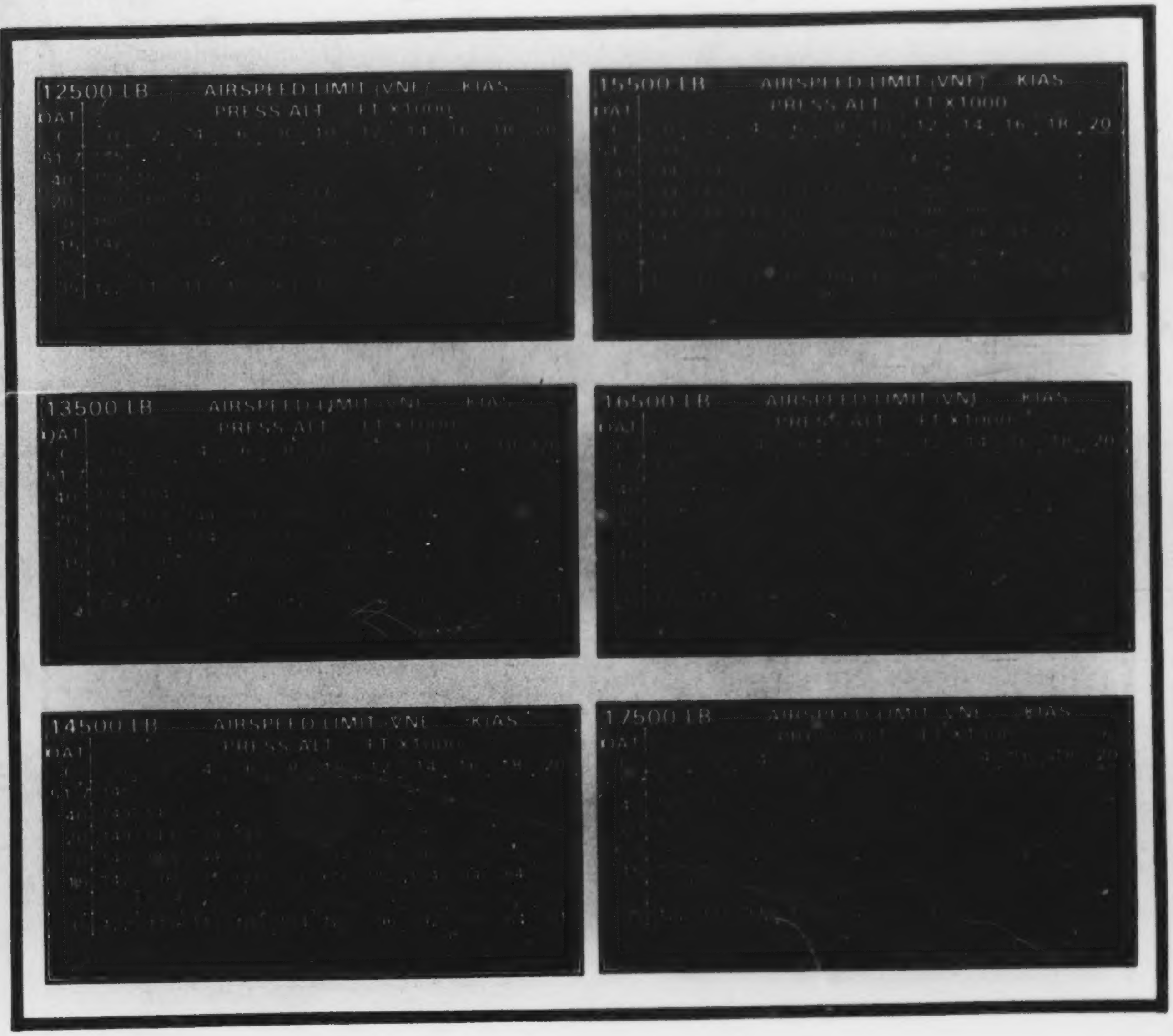

12500 LB AIRSPEED LIMIT (VNE) — KIAS
PRESS ALT — FT X1000
OAT
C
0 2 4 6 8 10 12 14 16 18 20
15500 LB AIRSPEED LIMIT (VNE) — KIAS
PRESS ALT — FT X1000
OAT
0 2 4 6 8 10 12 14 16 18 20
13500 LB AIRSPEED LIMIT (VNE) — KIAS
PRESS ALT — FT X1000
OAT
16500 LB AIRSPEED LIMIT (VNE) — KIAS
PRESS ALT — FT X1000
OAT
14500 LB AIRSPEED LIMIT (VNE) — KIAS
PRESS ALT — FT X1000
OAT
17500 LB AIRSPEED LIMIT (VNE) — KIAS
PRESS ALT — FT X1000
OAT

FIGURE 116.—Airspeed Limit.

SINGLE ENGINE LANDING DISTANCE OVER 50 FT. OBSTACLE

2.5 MIN. OEI POWER AS REQUIRED

RATE OF DESCENT 500 FT/MIN

ENGINE RPM 100%

52° TO -35°C

HARD SURFACED RUNWAY

GENERATOR 400 AMPS

HEATER OFF

45 KIAS AT 50 FEET

INOPERATIVE ENGINE SECURED

ENGINE AND ENGINE INLET ANTI-ICE OFF

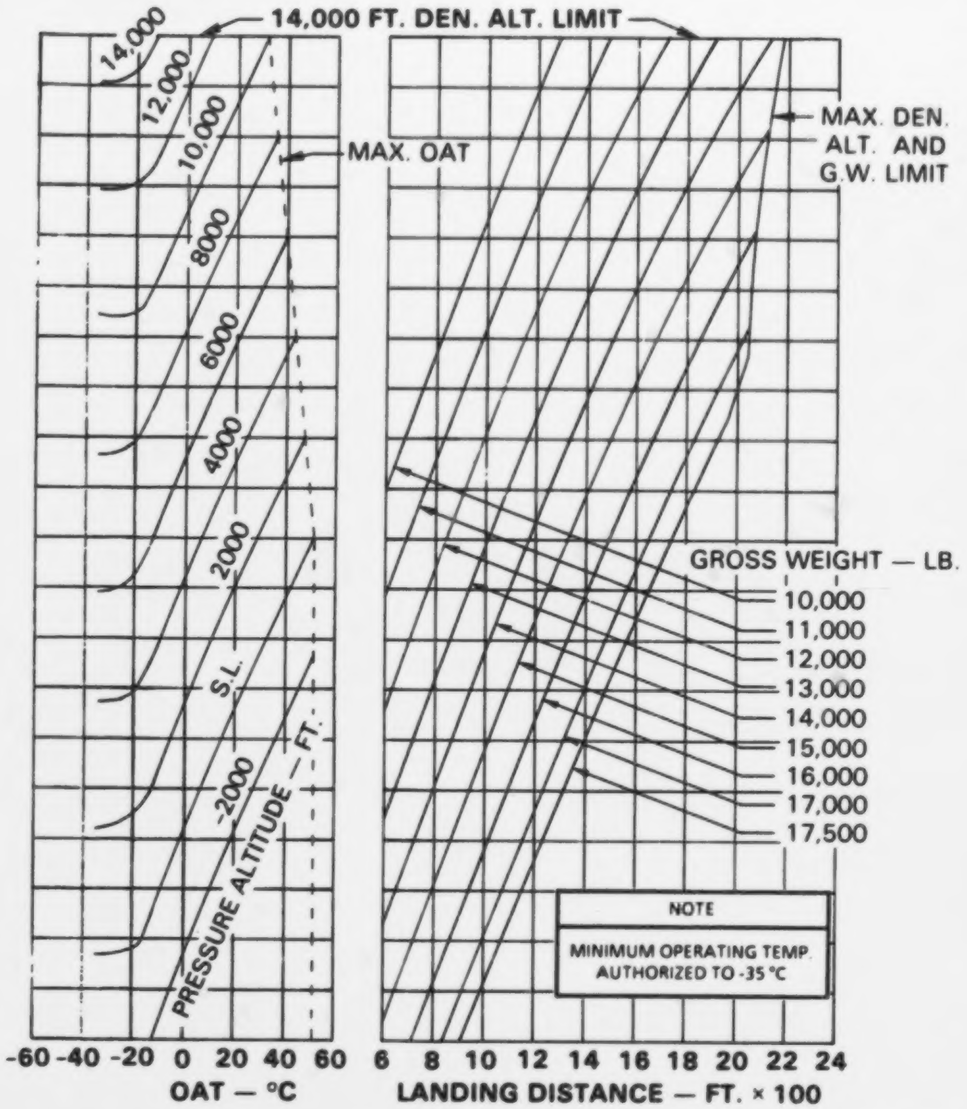


FIGURE 117.—Single-Engine Landing Distance Over 50-Foot Obstacle.

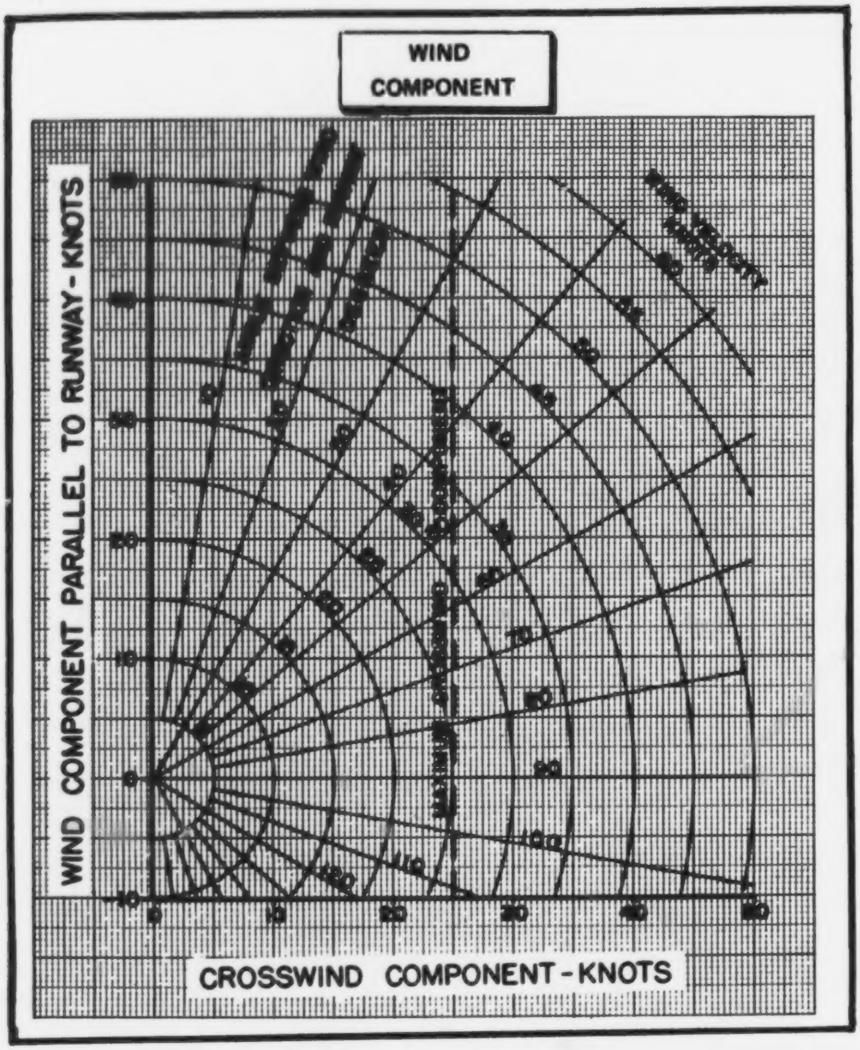


FIGURE 118.—Wind Component Chart.

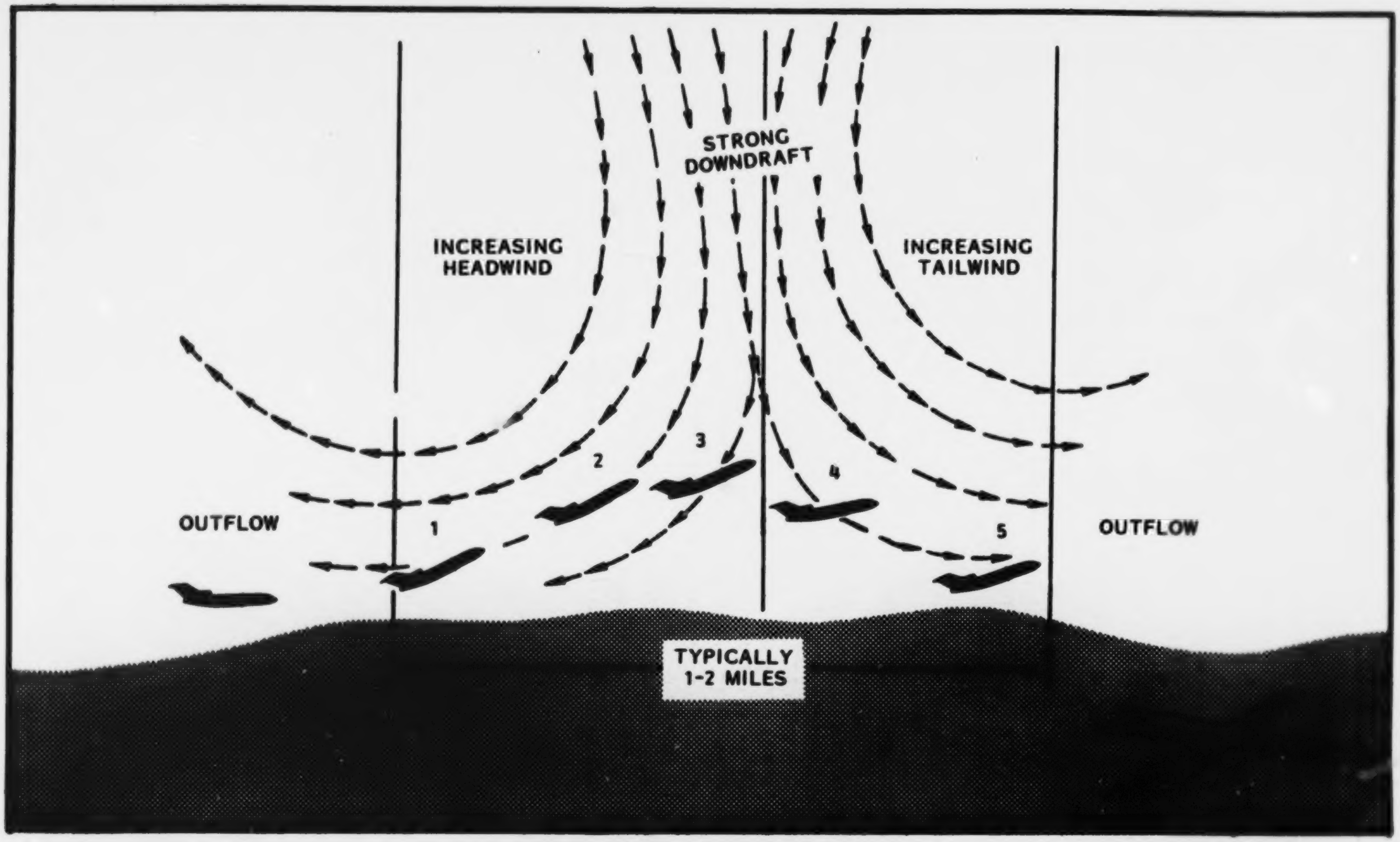

STRONG DOWNDRAFT
INCREASING HEADWIND
INCREASING TAILWIND
OUTFLOW
OUTFLOW
1
2
3
4
5
TYPICALLY 1-2 MILES

FIGURE 119.—Microburst Section Chart.

SURFACE AVIATION WEATHER REPORT

```
AUS SA 1753 40 SCT E250 BKN 8 170/87/69/1911G17/006
BPT SA 1755 30 SCT E250 BKN 7 183/93/74/1704/007
BRO SA 1755 34 SCT 250 -OVC 6H 163/93/74/1415/001
CDS SA 1758 E18 OVC 7RW- 183/73/69/1113/012/RW+ E-S BINOVC
   RB20
CLL SA 1749 30 SCT 250 -BKN 7 181/93/69/2111/008
COT SA 1749 40 SCT 200 SCT 10 160/87/70/1310/002
CRP SA 1753 28 SCT E250 BKN 10 169/90/75/1616/003
DAL SA 1755 23 SCT E100 OVC 7 87/71/1605/007/HLYR
DFW SA 1800 35 SCT E120 OVC 10 174/85/68/1707/008
DHT RS 1756 E25 BKN 15 200/72/59/0414/026
DRT SA 1756 20 SCT E100 BKN 250 OVC 10 145/82/72/1212/000
ELP SA 1755 70 SCT 250 SCT 60 131/84/56/0907/015
FTW SA 1750 25 -SCT E100 OVC 7 84/68/1807/008
FTW UA /OV DFW 180005/TM 1803/FL095/TP PA30/SK 036 OVC 060/070 OVC 075/OVC ABV
GGG SA 1745 250 SCT 15 89/69/1508/011
GLS SA 1755 25 SCT E200 BKN 7 92/71
GLS SP 1811 AMOS 86/74/1705/007/000
HOU SA 1752 30 SCT E250 OVC 7 89/70/1506/008
HRL SA 1753 E250 OVC 7 93/72/1415/002/ FEW CU E
IAH SA 1755 33 SCT E250 BKN 10 181/87/73/1207/007
INK SA 1755 E30 BKN 60 BKN 250 BKN 20 144/81/61/0406/088
LBB SA 1750 E12 BKN 30 BKN 100 BKN 12 164/70/67/0413/015/ RB15E40
LBB SP 1818 15 SCT E30 BKN 100 BKN 12 0412/015
LBB UA /OV LBB 045002/TM 1821/FL060/TP B727/SK 045 BKN 053 TOPS RGD
LFK SA 1756 300 -BKN 7 182/91/66/2407/008
MAF SA 1756 M25 BKN 250 OVC 12 142/80/64/0220/009 RWU E-S
MFE SA 1756 250 -BKN 7 151/92/66/1315/998
MRF SA 1752 AMOS E30 BKN 60 125/81/57/0912/000/ PK WND 20
MRF SP 1811 AMOS 83/58/0809/000 PK WND 20
```

FIGURE 120.—Surface Aviation Weather Report.

### SURFACE AVIATION WEATHER REPORT

```
MWL SA 1756 E11 BKN 50 OVC 10 E169/77/73/1311/006
PSX SA 1755 18 SCT E200 OVC 7 183/87/76/2010/007
PVW SA 1750 12 SCT E30 OVC 10 185/85/66/0506/011/ BINOVC NE
SAT SA 1756 28 SCT E250 OVC 7 164/85/69/1516/005/ UA /OV SAT TM 1739/FL UNKN/TP
UNKN/SK TOPS 040
SJT SA 1755 E18 BKN 70 OVC 7 170/77/72/2212/002
SPS RS 1757 9 SCT M25 OVC 6R- 185/75/71/0914/011
SPS SP 1820 M15 OVC 6R- 1010/011
SPS UA /OV SPS/TM 1815/FL090/TP C402/SK OVC 050-060
TPL SA 1751 15 SCT 100 SCT 250 -OVC 15 89/69/1715/007
VCT SA 1755 30 SCT E250 OVC 7 179/88/73/1713/005

AR

ELD SA 1755 250 -BKN 6H 190/88/70/0605/010
FSM SA 1756 E80 BKN 120 OVC 20 191/86/69/2805/011
FSM UA /OV HRO-FSM/TM 1825/FL290/TP B737/RM SCT TOPS 290
FYV SA 1755 35 SCT E80 BKN 250 OVC 15 202/83/70/1705/016/ RWU SE
HOT SA 1751 40 SCT E150 OVC 15 91/62/3406/010
HRO RS 1755 20 SCT E35 BKN 13T 195/84/72/3007/015/ TB30 S-SSW MOVG E FQT THDR
HRO SP 1825 E15 BKN 35 BKN 13TRW- 1810G20/016/ T SE-W MOVG NE LTGICG RB25
LIT SA 1754 30 SCT E250 BKN 10 182/93/69/0704/007
PBF SA 1753 40 SCT E100 BKN 5H E183/95/68/2907/007
TXK SA 1753 100 SCT 200 -BKN 7 92/66/2503/010
```

FIGURE 121.—Surface Aviation Weather Report.

TERMINAL FORECAST

TX

ALI FT 031515 C12 BKN 6H 1415. 17Z C30 BKN 1515G25. 19Z 40 SCT C250 BKN 1515G25 SLGT CHC C20 BKN 3TRW. 01Z 150 SCT 1315. 07Z C8 BKN. 09Z IFR CIG. 14Z MVFR CIG..

AMA FT 031515 C10 BKN 80 BKN 0512 OCNL C10 OVC 2TRW+. 18Z C20 BKN 80 OVC 0315 OCNL C10 OVC 2TRW+. 14Z C10 OVC 5R-F 0312. 09Z IFR CIG R F..

AUS FT COR 031615 1545 C25 BKN 100 OVC 1710. 18Z C30 BKN 100 OVC 1710 CHC C10 OVC 1TRW. 04Z C14 BKN CHC C10 OVC 1TRW. 09Z MVFR CIG TRW..

BPT FT 031515 25 SCT 6H. 17Z 30 SCT 250 SCT 1810. 01Z 250 SCT. 09Z VFR. 10Z MVFR FK..

CRP FT 031515 20 SCT C250 BKN 1515G25. 18Z 30 SCT C250 BKN 1615G25 SLGT CHC TRW. 01Z 150 SCT 1615. 09Z VFR..

DAL FT 031515 30 SCT C100 BKN. 17Z C30 BKN 100 OVC CHC C10 OVC 2TRW. 01Z C20 BKN CHC 3TRW. 09Z MVFR CIG TRW..

DRT FT AMD 1 031515 1520Z C14 OVC 1410. 16Z C20 BKN 100 OVC 1410 CHC 3TRW. 19Z C30 BKN 100 BKN 1412 CHC C20 BKN 3TRW. 02Z 35 SCT C80 BKN CHC C20 BKN 3TRW. 09Z MVFR CIG TRW..

ELP FT 031515 70 SCT 100 SCT. 17Z 70 SCT C120 BKN 0812 CHC C50 BKN 5TRW G35. 08Z C70 BKN 0712 SLGT CHC RW-. 09Z MVFR CIG..

HOU FT 031515 20 SCT 6H. 17Z 35 SCT 250 SCT 1810. 01Z 250 SCT. 09Z VFR. 11Z MVFR FK..

IAH FT 031515 20 SCT 6H. 17Z 35 SCT 250 SCT 1810. 01Z 250 SCT. 09Z VFR. 11Z MVFR FK..

INK FT 031515 20 SCT 100 SCT 1010. 16Z C25 BKN 80 BKN 0813 CHC C10 OVC 1TRW+A G35. 04Z C20 BKN 50 OVC 0513 OCNL C10 OVC 1TRW+. 09Z MVFR CIG R F. 11Z IFR CIG R F..

LBB FT 031515 C10 BKN 50 OVC 0612 CHC 10 SCT C20 OVC 3TRW. 17Z C20 BKN 60 OVC 0415 OCNL C10 OVC 1TRW+. 04Z C10 OVC 4R-F OCNL 1TRW+. 09Z IFR CIG R F..

SAT FT 031515 C16 BKN 6H 1710. 17Z C25 BKN 1715. 19Z C30 BKN 250 OVC 1715 CHC C20 BKN 3TRW. 05Z C14 BKN CHC 3TRW. 09Z MVFR CIG TRW..

SJT FT 031515 C15 BKN 50 OVC 1210 OCNL C8 OVC 4TRW. 20Z C25 BKN 70 OVC 0912 OCNL C8 OVC 1TRW+. 09Z IFR CIG R F..

SPS FT 031515 30 SCT C80 BKN 0712 CHC C10 OVC 2TRW. 09Z MVFR CIG TRW..

FIGURE 122.—Terminal Forecast.

AREA FORECAST

DFWH FA 031040
HAZARDS VALID UNTIL 032300
OK TX AR LA TN MS AL AND CSTL WTRS
FLT PRCTNS...IFR...OK TX
...MTN OBSCN...TN AL
...TSTMS...OK AR TN AL

TSTMS IMPLY PSBL SVR OR GTR TURBC SVR ICG AND LLWS
NON MSL HGTS NOTED BY AGL OR CIG
THIS FA ISSUANCE INCORPORATES THE FOLLOWING AIRMETS STILL IN EFFECT...NONE

...

DFWS FA 031040
SYNOPSIS VALID UNTIL 040500
AT 11Z STNRY FNT ALG LOU MEM ABI MRF LN. LGT MOIST NELY LOW LVL FLOW N OF FNT. S OF FNT MDT SELY LOW LVL FLOW FM GLF OVR TX AND LGT WNDS ELSW. LTL CHG IN SYNOPTIC PATTERN THRU PD.

...

DFWI FA 031040
ICING AND FRZLVL VALID UNTIL 032300
NO SGFNT ICING EXPCD OUTSIDE CNVTV ACTVTY.
FRZLVL 130 N PTN TO 160 S PTN OF AREA.

...

DFWT FA 031040
TURBC VALID UNTIL 032300
NO SGFNT TURBC EXPCD OUTSIDE CNVTV ACTVTY.

...

DFWC FA 031040 SGFNT CLOUD AND WX VALID UNTIL 032300...OTLK 032300-040500
IFR...TX OK
FM LAR TO OSW TO SAT TO MAF TO LAR
CIGS BLO 10 VSBYS AOB 3F. CONDS IMPVG AFT 19Z.
MTN OBSCN...TN AL
FM BML TO AGS TO BMH TO LOZ TO BML
MTNS ERN TN AND NERN AL OCNLY OBSCD IN CLDS AND PCPN.
TX OK N OF ROW MAF SAT OSW LN
CIGS BLO 10 VSBYS AOB 3F WITH MEGG LYRS TO ABV 240. WDLY SCT LGT RAIN. CONDS BCMG BY 19Z CIGS 15-25 BKN-OVC AND MEGG LYRS TO ABV 240 WITH SCT LGT RAIN AND WDLY SCT EMBDD RSHWRS. RSHWRS BCMG TSHWRS 17Z-23Z. CB TOPS TO 350. OTLK...MVFR CIGS F TRW BCMG IFR CIG BY 05Z.

.

RMNDR TX
VSBYS 3-5H ERN PTN AND OCNL CIGS 10-30 OVC 50 MSTLY CNTRL PTN. AFT 17Z CONDS BCMG CU 30-40 SCT-BKN 100. OTLK...MVFR CIG TRW.
RMNDR OK AR EXTRM WRN TN
GNLY 90 OVC WITH MEGG LYRS TO 160 EXCP OCNL CIGS 15-25 OVC IN SCT TRW-. CB TOPS TO 350. OTLK...MVFR CIG TRW.

FIGURE 123.—Area Forecast.

### CONVECTIVE SIGMET

MKCC WST 031755
CONVECTIVE SIGMET 42C
VALID UNTIL 1955Z
TX OK
FROM 5W MLC-PEQ-SJT-5W MLC
AREA SCT EMBDD TSTMS MOVG LTL. TOPS 300.

CONVECTIVE SIGMET 43C
VALID UNTIL 1955Z
CO KS OK
FROM AKO-OSW-30WNW OKC-AKO
AREA SCT TSTMS OCNLY EMBDD MOVG FROM 3220. TOPS 380.

CONVECTIVE SIGMET 44C
VALID UNTIL 1955Z
50NE MEM
ISOLD INTSD LVL5 TSTM DIAM 10 MOVG FROM 2625. TOP ABV 450.

OUTLOOK VALID UNTIL 2355Z
TSTMS OVR TX AND SE OK WL MOV SEWD 15 KTS.
TSTMS OVR CO, KS, AND N OK WL CONT MOVG SEWD 20 KTS.
TSTM OVR TN WL CONT MOVG EWD 25 KTS.

FIGURE 124.—Convective Sigmet.

## WINDS AND TEMPERATURES ALOFT FORECAST

DATA BASED ON 031200Z
VALID 040000Z FOR USE 1800-0300Z. TEMPS NEG ABV 24000

| FT | 3000 | 6000 | 9000 | 12000 | 18000 | 24000 | 30000 | 34000 | 39000 |
|---|---|---|---|---|---|---|---|---|---|
| ABI |  | 1306+16 | 1607+11 | 1807+06 | 2108-07 | 2208-18 | 240833 | 250942 | 300753 |
| ABO |  |  | 0810+14 | 0511+08 | 3415-06 | 3220-18 | 312333 | 312543 | 302554 |
| AMA |  | 0614 | 0814+10 | 0709+05 | 3210-07 | 2914-19 | 281934 | 282243 | 292554 |
| ATL | 0906 | 9900+17 | 9900+12 | 0205+07 | 3507-07 | 3305-19 | 290534 | 280543 | 990054 |
| BNA | 9900 | 9900+17 | 3205+12 | 3109+07 | 3018-07 | 2918-19 | 272134 | 262444 | 262855 |
| BRO | 1510 | 1614+20 | 1611+14 | 1708+08 | 9900-07 | 9900-19 | 990034 | 990043 | 990055 |
| DAL | 0910 | 1706+17 | 2009+11 | 2011+06 | 2015-08 | 2214-19 | 231333 | 241342 | 271153 |
| DEN |  |  | 9900+09 | 9900+04 | 3020-10 | 3029-21 | 303636 | 304145 | 294756 |
| DSM | 3615 | 3315+07 | 3118+04 | 3022+00 | 2835-12 | 2748-24 | 276438 | 277348 | 277957 |
| ELP |  | 0610 | 0614+13 | 0615+08 | 0113-05 | 3614-17 | 361433 | 361442 | 251354 |
| GCK |  | 0611+11 | 0809+08 | 9900+03 | 2817-09 | 2823-20 | 273135 | 273644 | 284155 |
| HLC |  | 0409+09 | 0405+07 | 3106+02 | 2822-10 | 2730-21 | 273936 | 274545 | 275256 |
| HOU | 0909 | 1607+19 | 1606+13 | 1606+07 | 1605-08 | 9900-20 | 990034 | 990043 | 990054 |
| ICT | 0516 | 0613+12 | 0607+08 | 9900+04 | 2718-09 | 2626-20 | 263635 | 264144 | 274655 |
| IND | 3611 | 3207+12 | 2912+08 | 2818+03 | 2733-09 | 2643-21 | 265635 | 265944 | 256255 |
| INK |  | 0609+16 | 0709+12 | 0608+07 | 0107-06 | 3607-18 | 350833 | 340842 | 350855 |
| JAN | 3612 | 3613+18 | 3611+13 | 3609+07 | 0105-08 | 9900-19 | 990034 | 990043 | 230854 |
| LIT | 0310 | 3608+16 | 3206+11 | 2808+06 | 2517-08 | 2518-19 | 252034 | 252243 | 262454 |
| LOU | 0105 | 9900+15 | 2908+10 | 2913+05 | 2825-08 | 2731-20 | 263834 | 264143 | 254454 |
| MEM | 0109 | 0108+17 | 3408+12 | 3110+06 | 2916-07 | 2717-19 | 261934 | 262144 | 262555 |
| MKC | 0316 | 0211+11 | 3409+07 | 3013+03 | 2728-10 | 2638-21 | 265036 | 265645 | 276356 |
| MSY | 0315 | 0216+19 | 0315+13 | 0414+07 | 0510-08 | 0605-20 | 990034 | 990043 | 210854 |
| OKC | 0715 | 0810+14 | 1106+10 | 9900+05 | 2414-08 | 2419-19 | 252534 | 252743 | 272754 |
| SAT | 1107 | 1713+18 | 1813+13 | 1911+07 | 2006-07 | 1906-19 | 180734 | 170743 | 990054 |
| SGF | 0414 | 0410+14 | 3605+09 | 2908+04 | 2624-09 | 2632-20 | 254135 | 264444 | 264655 |
| SHV | 0509 | 9900+18 | 9900+12 | 2106+06 | 2012-08 | 2109-19 | 220734 | 240743 | 260754 |
| STL | 0314 | 0110+12 | 3210+08 | 2915+03 | 2730-09 | 2741-21 | 265435 | 265744 | 266055 |
| TUS |  | 0807+23 | 0814+16 | 0814+10 | 0810-05 | 0505-17 | 330533 | 310842 | 290954 |

FIGURE 125.—Winds and Temperatures Aloft Forecast.

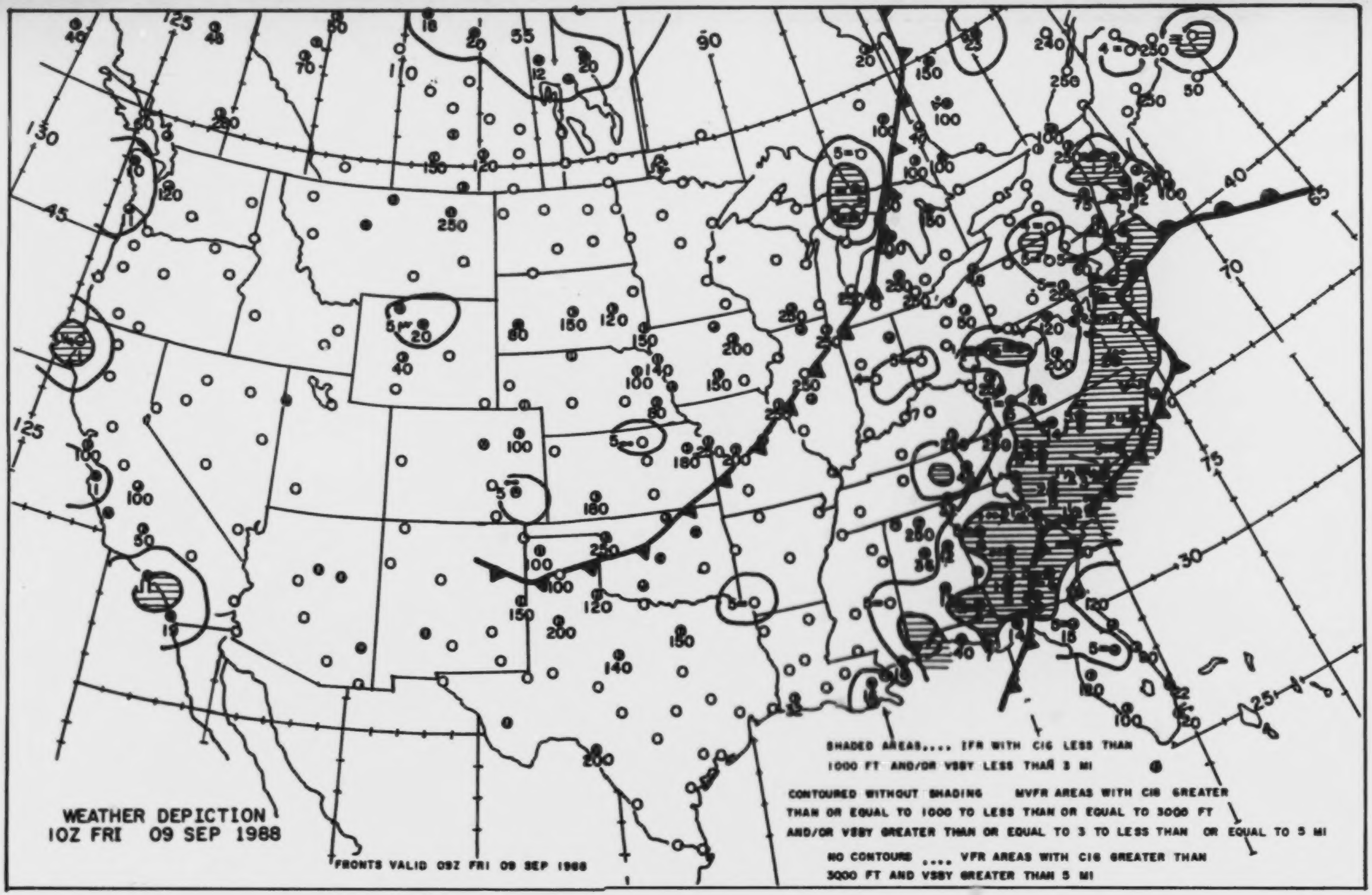

WEATHER DEPICTION
10Z FRI 09 SEP 1988
FRONTS VALID 09Z FRI 09 SEP 1988
SHADED AREAS.... IFR WITH CIG LESS THAN
1000 FT AND/OR VSBY LESS THAN 3 MI
CONTOURED WITHOUT SHADING MVFR AREAS WITH CIG GREATER
THAN OR EQUAL TO 1000 TO LESS THAN OR EQUAL TO 3000 FT
AND/OR VSBY GREATER THAN OR EQUAL TO 3 TO LESS THAN OR EQUAL TO 5 MI
NO CONTOURS .... VFR AREAS WITH CIG GREATER THAN
3000 FT AND VSBY GREATER THAN 5 MI

FIGURE 126.—Weather Depiction Chart.

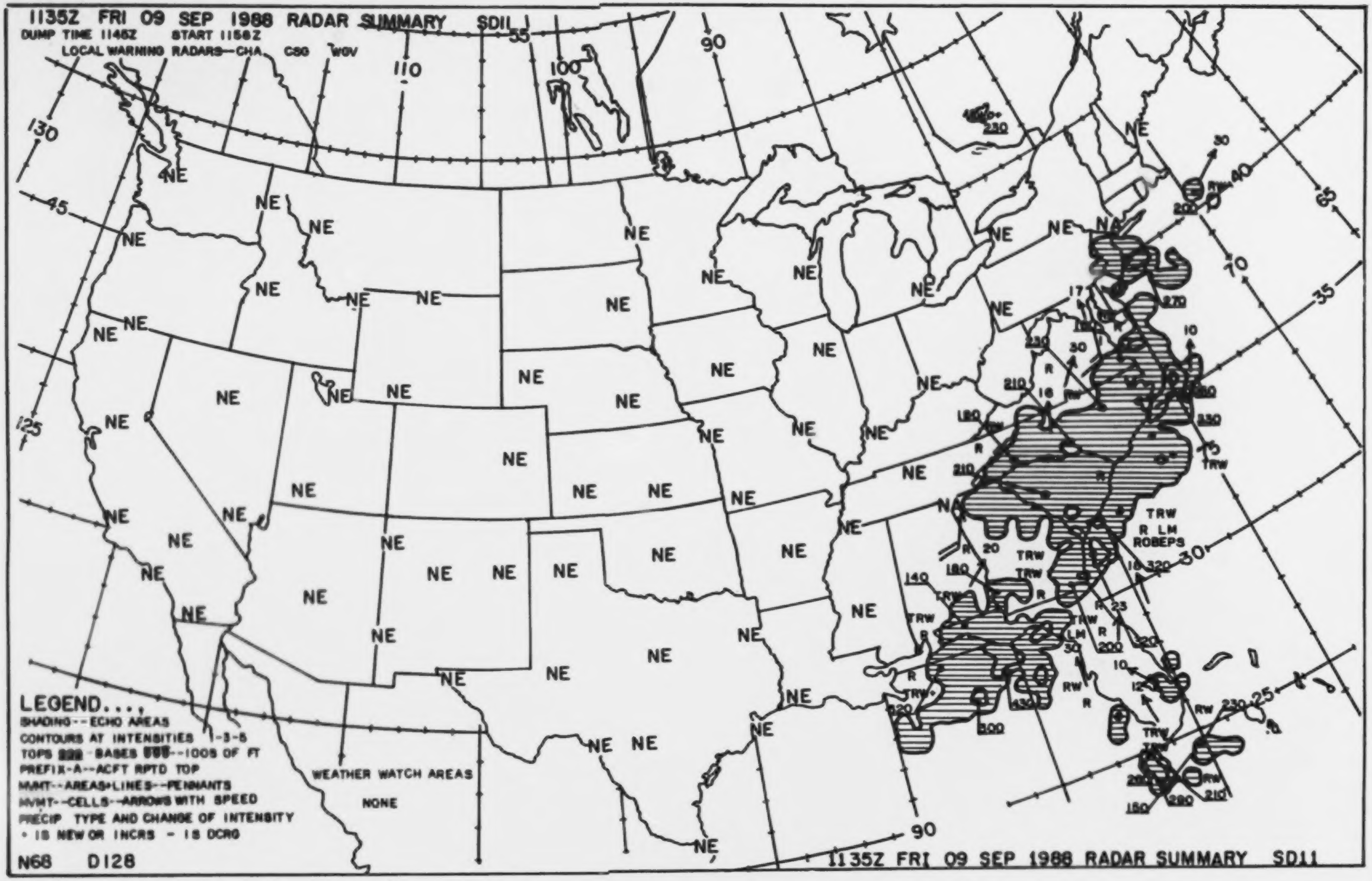

1135Z FRI 09 SEP 1988 RADAR SUMMARY SD11
DUMP TIME 1146Z START 1156Z
LOCAL WARNING RADARS--CHA CSG WOV
130
125
110
100
90
55
45
40
35
30
25
65
70
75
NE
NA
TRW
R LM
ROBEPS
TRW
R
RW
LM
30
10
17
16
18
20
23
12
140
150
180
200
210
220
230
270
280
290
320
330
430
LEGEND...
SHADING--ECHO AREAS
CONTOURS AT INTENSITIES 1-3-5
TOPS 220 BASES 000--100S OF FT
PREFIX-A--ACFT RPTD TOP
MVMT--AREAS+LINES--PENNANTS
MVMT--CELLS--ARROWS WITH SPEED
PRECIP TYPE AND CHANGE OF INTENSITY
+ IS NEW OR INCRS - IS DCRG
WEATHER WATCH AREAS
NONE
N68 D128
90
1135Z FRI 09 SEP 1988 RADAR SUMMARY SD11

FIGURE 127.—Radar Summary Chart.

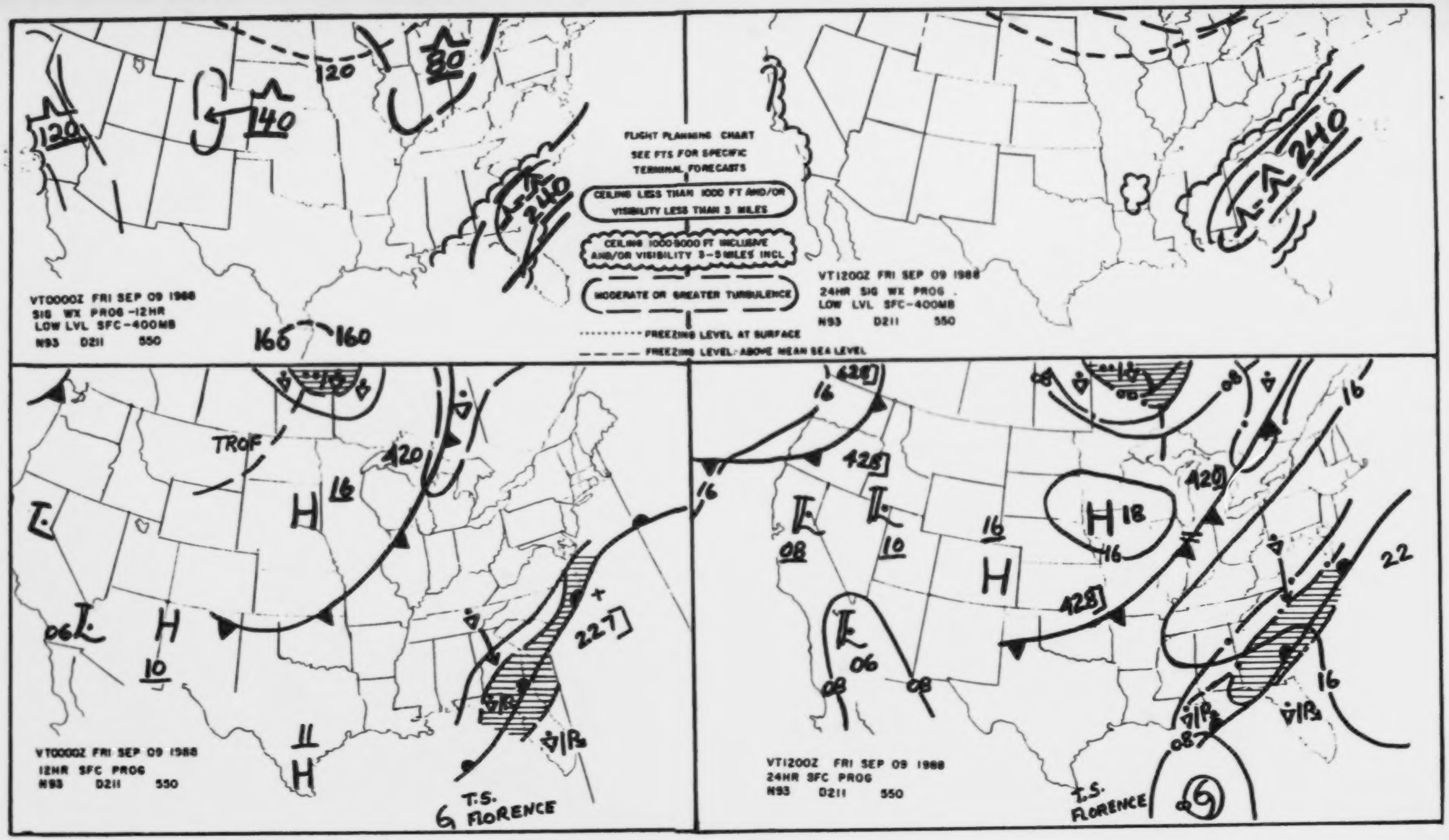

FLIGHT PLANNING CHART
SEE FTS FOR SPECIFIC TERMINAL FORECASTS
CEILING LESS THAN 1000 FT AND/OR VISIBILITY LESS THAN 3 MILES
CEILING 1000-3000 FT INCLUSIVE AND/OR VISIBILITY 3-5 MILES INCL
MODERATE OR GREATER TURBULENCE
FREEZING LEVEL AT SURFACE
FREEZING LEVEL- ABOVE MEAN SEA LEVEL
VT0000Z FRI SEP 09 1988
SIG WX PROG -12HR
LOW LVL SFC-400MB
N93 D211 550
VT1200Z FRI SEP 09 1988
24HR SIG WX PROG
LOW LVL SFC-400MB
N93 D211 550
VT0000Z FRI SEP 09 1988
12HR SFC PROG
N93 D211 550
VT1200Z FRI SEP 09 1988
24HR SFC PROG
N93 D211 550
120
140
120
80
240
166
160
240
TROF
H
16
L
06
H
10
11
H
420
227
T.S. FLORENCE
428
L
08
L
10
16
H
H 18
16
428
429
L
06
08
08
22
16
08
T.S. FLORENCE

FIGURE 128.—Significant Weather Prognostic Chart.

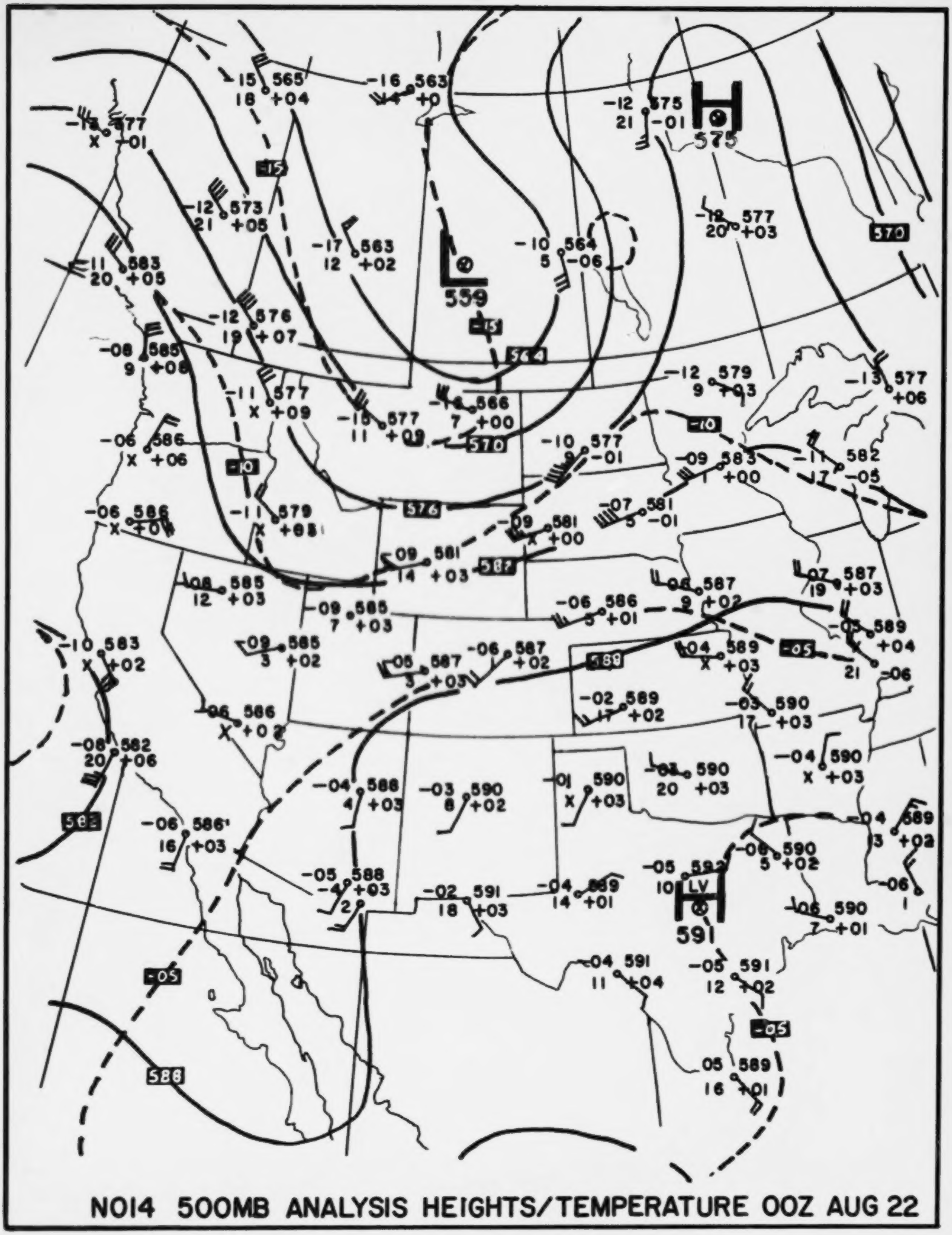

N014 500MB ANALYSIS HEIGHTS/TEMPERATURE 00Z AUG 22
H
575
L
559
LV
H
591
-15
570
-15
564
570
-10
-10
576
582
588
-05
582
588
-05
-05
-15 565
18 +04
-16 563
14 +0
-13 577
X +01
-12 575
21 -01
-12 573
21 +05
-17 563
12 +02
-10 564
5 -06
-12 577
20 +03
-11 583
20 +05
-12 576
19 +07
-08 585
9 +08
-11 577
X +09
-15 577
11 +09
-13 566
7 +00
-12 579
9 +03
-13 577
+06
-06 586
X +06
-10 577
9 -01
-09 583
1 +00
-11 582
17 -05
-06 586
X +04
-11 579
X +03
-07 581
5 -01
-09 581
X +00
-09 581
14 +03
-08 585
12 +03
-09 585
7 +03
-06 587
9 +02
-07 587
19 +03
-06 586
5 +01
-10 583
X +02
-09 585
3 +02
-08 587
3 +03
-06 587
+02
-04 589
X +03
-05 589
21 +04
-06
-02 589
17 +02
-03 590
17 +03
-06 586
X +02
-08 582
20 +06
-04 590
X +03
-04 588
4 +03
-03 590
8 +02
-01 590
X +03
-03 590
20 +03
-04 589
13 +02
-06 586
16 +03
-06 590
5 +02
-05 592
10
-05 588
-4 +03
2
-02 591
18 +03
-04 589
14 +01
-06
1
-06 590
7 +01
-04 591
11 +04
-05 591
12 +02
05 589
16 +01

FIGURE 129.—500 MB Analysis Heights/Temperature Chart.

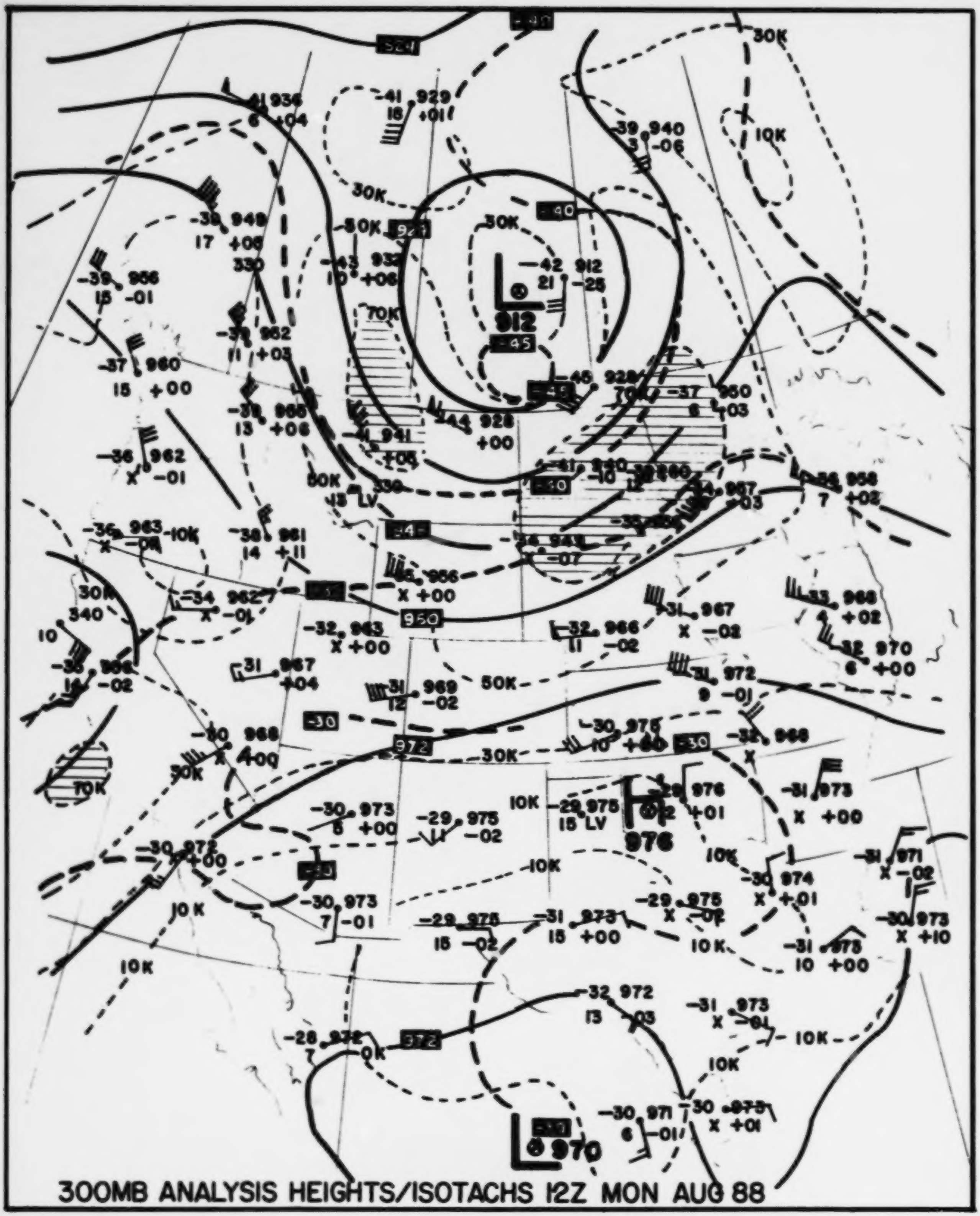

300MB ANALYSIS HEIGHTS/ISOTACHS 12Z MON AUG 88
912
976
970
30K
10K
50K
70K
-40
-45
-30
924
930
950
972
-41 936
6 +04
-41 929
16 +01
-39 940
3 -06
-38 949
17 +06
-42 912
21 -25
-46 928
-44 928
+00
-37 950
6 -03
-39 956
15 -01
-37 960
15 +00
-36 962
X -01
-36 963
X -01
-38 961
14 +11
-34 962
X -01
-32 963
X +00
-31 967
+04
-31 969
12 -02
-32 966
11 -02
-31 967
X -02
-31 972
9 -01
-33 968
4 +02
-32 970
6 +00
-30 968
X +00
-30 975
10 +00
-32 968
X
-29 976
2 +01
-29 975
15 LV
-31 973
X +00
-30 973
8 +00
-29 975
-02
-30 972
X +00
-30 973
7 -01
-29 975
15 -02
-31 973
15 +00
-29 975
X -02
-30 974
X +01
-31 971
X -02
-30 973
X +10
-31 973
10 +00
-32 972
13 -03
-31 973
X -01
-28 972
7
-30 971
6 -01
-30 973
X +01
-56 956
7 +02

FIGURE 130.—300 MB Analysis Heights/Isotachs Chart.

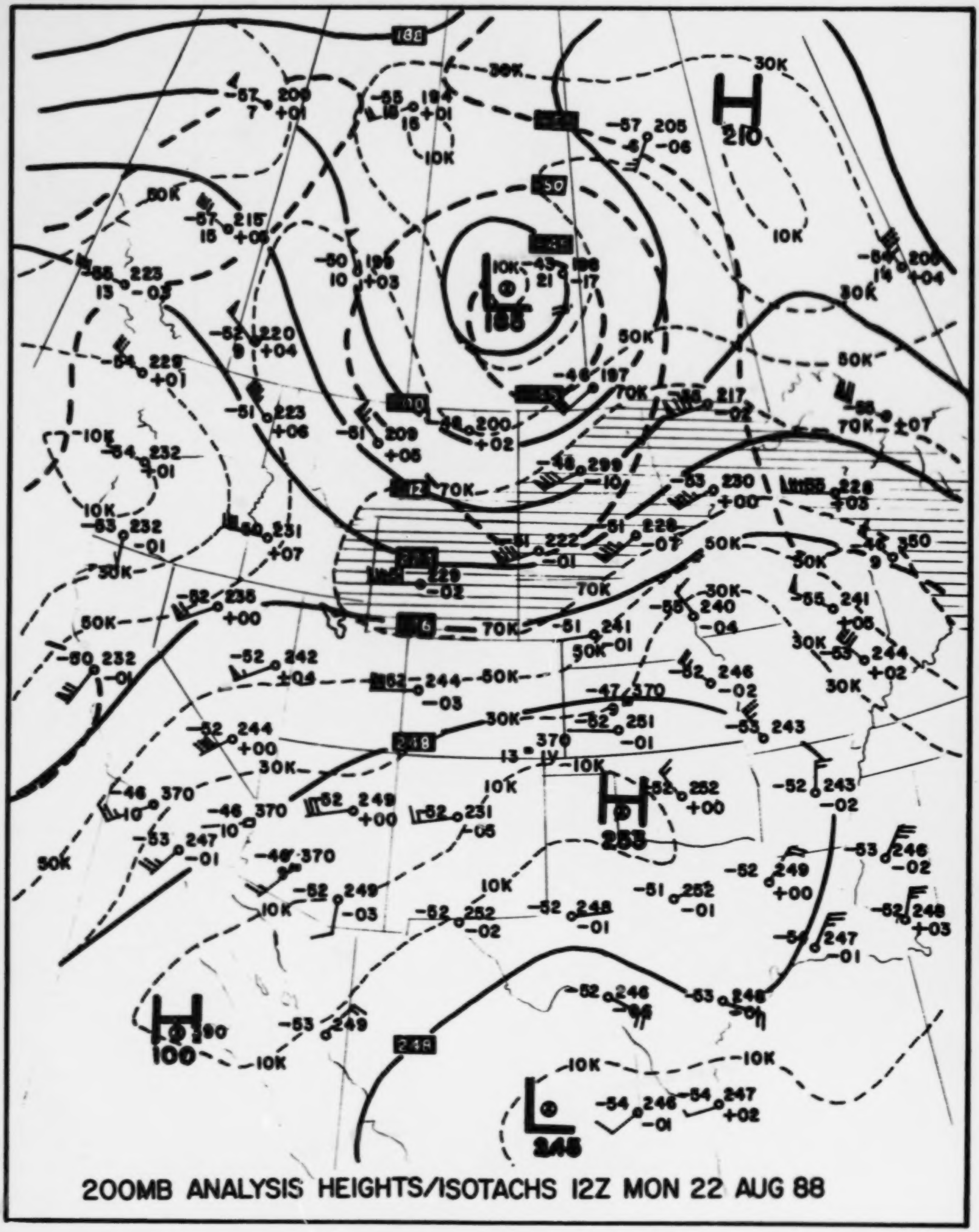

200MB ANALYSIS HEIGHTS/ISOTACHS 12Z MON 22 AUG 88
H
210
L
188
H
253
H
100
L
245
188
248
30K
50K
70K
10K
-57 200 7 +01
-55 194 15 +01
-57 205 -06
-57 215 15 +05
-55 223 13 -03
-50 199 10 +03
-43 196 21 -17
-64 208 14 +04
-52 220 9 +04
-54 229 +01
-46 197
-55 217 -02
-51 223 +06
-51 209 +05
-46 200 +02
-48 299 -10
-53 230 +00
-55 228 +03
-54 232 +01
-53 232 -01
-50 231 +07
-51 222 -01
-51 228 -07
-48 350 9
-52 229 -02
-52 238 +00
-55 240 -04
-55 241 +05
-51 241 -01
-50 232 -01
-52 242 ±04
-52 244 -03
-52 246 -02
-53 244 +02
-47 370
-52 251 -01
-53 243
-52 244 +00
13 370
-52 252 +00
-52 243 -02
-46 370 10
-46 370 10
-52 249 +00
-52 231 -05
-53 247 -01
-46 370
-53 246 -02
-52 249 +00
-52 249 -03
-51 252 -01
-52 252 -02
-52 248 -01
-52 248 +03
-54 247 -01
-52 246 -06
-53 246 -01
-53 249
-54 246 -01
-54 247 +02

FIGURE 131.—200 MB Analysis Heights/Isotachs Chart.

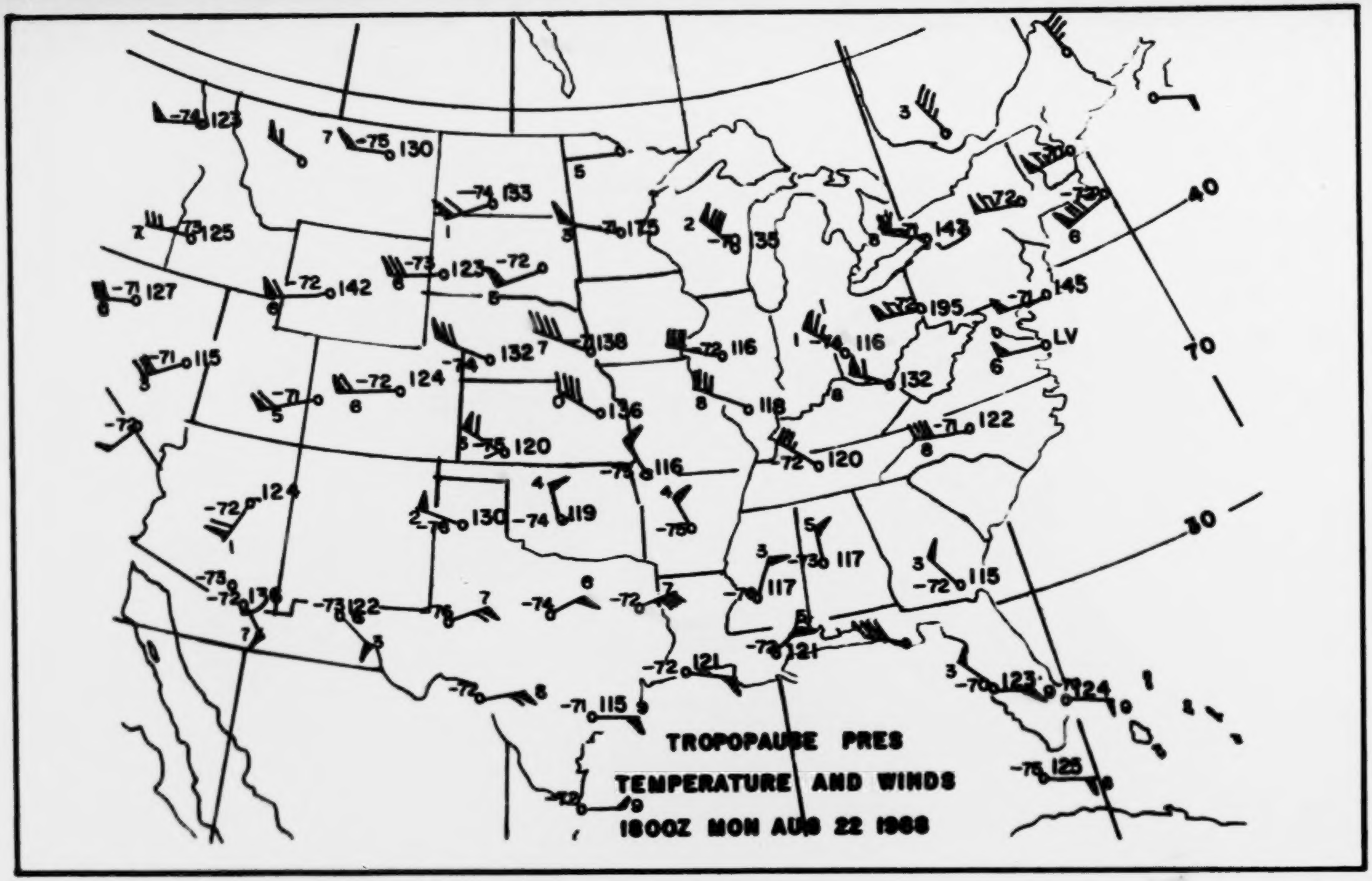

TROPOPAUSE PRES
TEMPERATURE AND WINDS
1800Z MON AUG 22 1988
40
70
30

FIGURE 132A.—Tropopause Pressure.

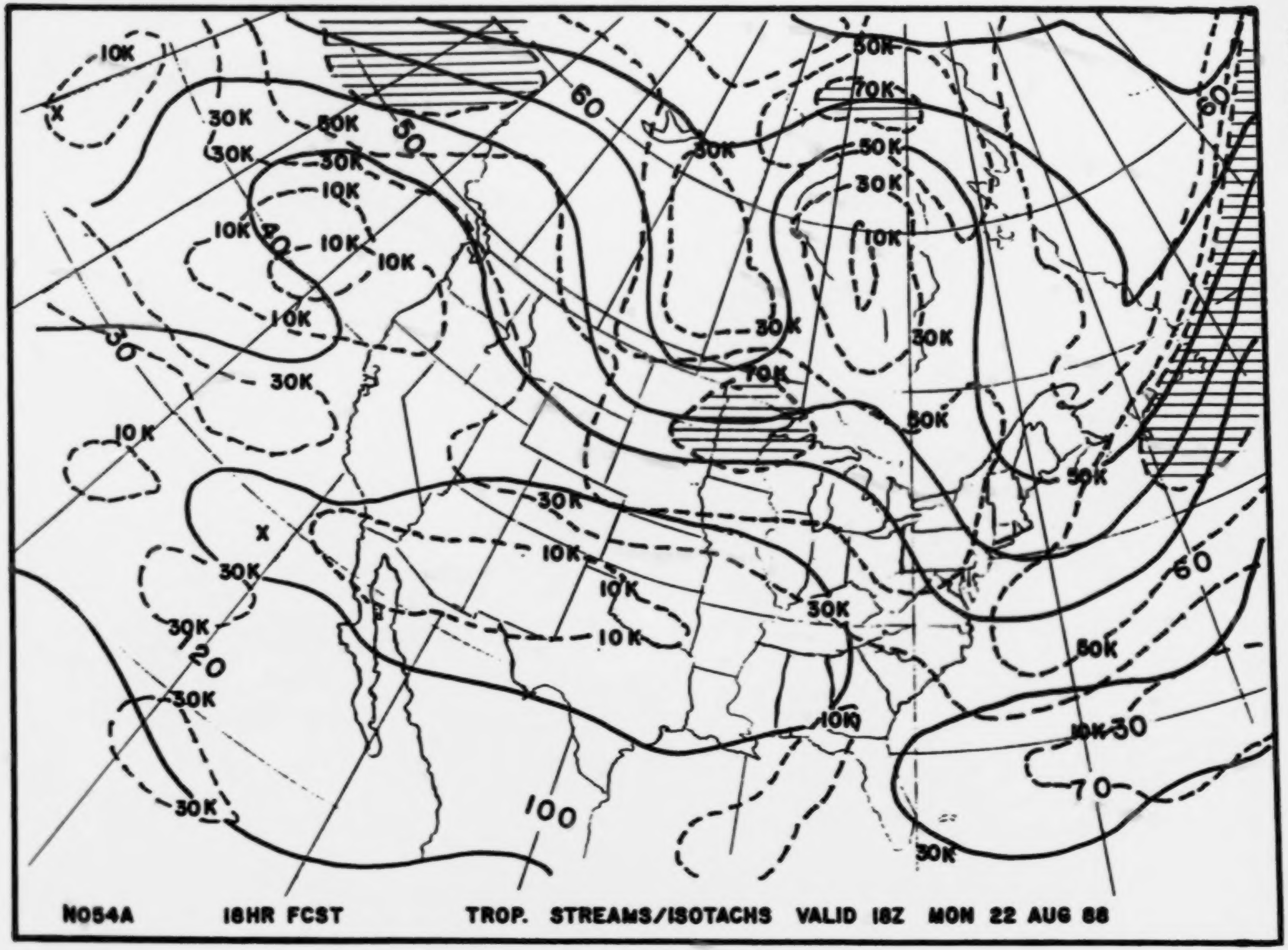

10K
X
30K
30K
50K
60
50
30K
10K
10K
40
10K
10K
10K
30
30K
10K
X
30K
30K
120
30K
30K
100
50K
70K
50K
30K
10K
30K
30K
70K
50K
30K
10K
10K
10K
30K
10K
60
60
50K
60
10K 30
70
30K
N054A
18HR FCST
TROP. STREAMS/ISOTACHS VALID 18Z MON 22 AUG 88

FIGURE 132B.—Tropopause/Streams Isotachs.

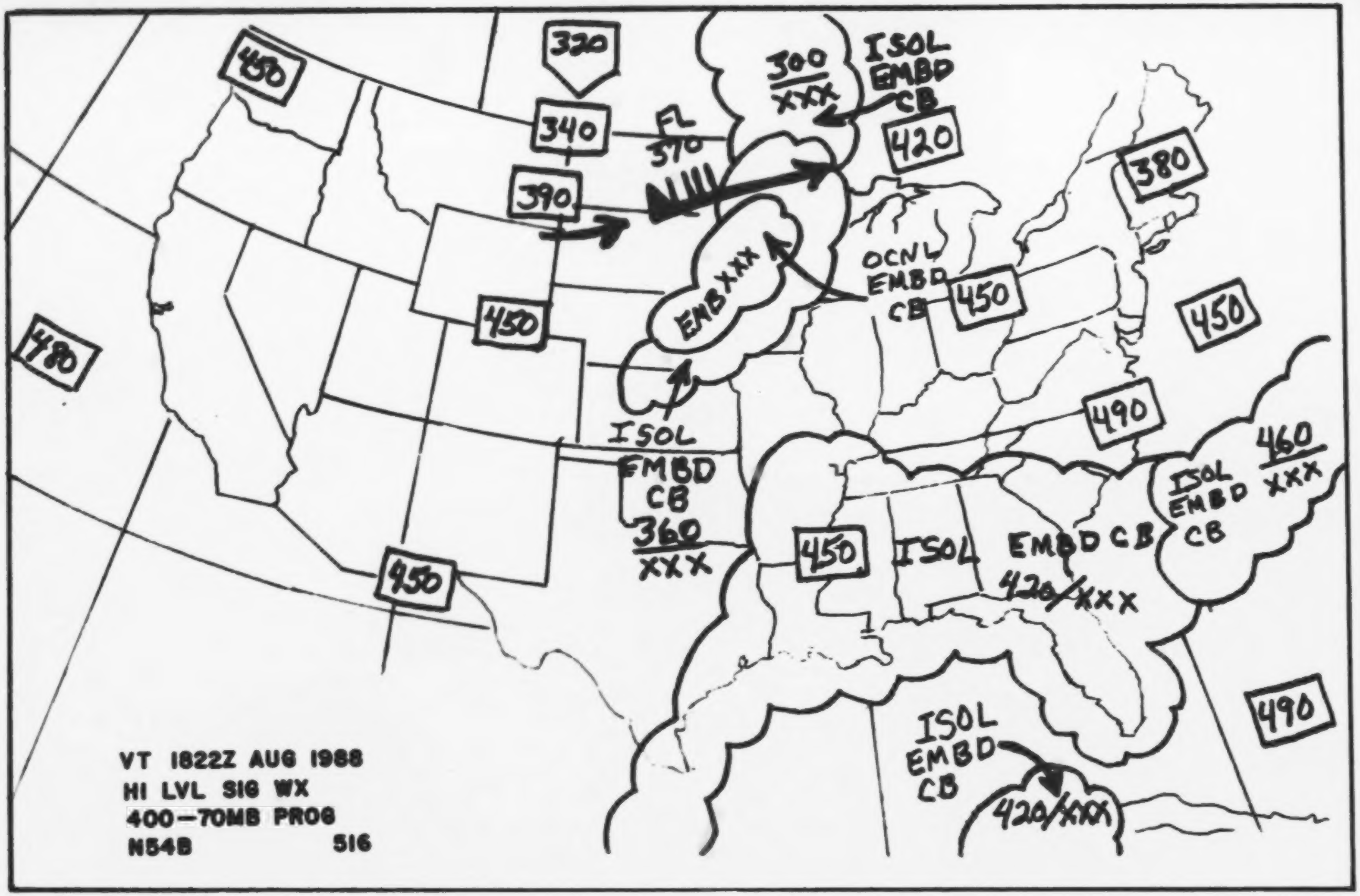

450
320
340
FL 370
390
300
XXX
ISOL
EMBD
CB
420
380
EMB XXX
OCNL
EMBD
CB
450
450
450
480
490
ISOL
EMBD
CB
360
XXX
460
XXX
ISOL
EMBD
CB
450
ISOL EMBD CB
420/XXX
450
490
ISOL
EMBD
CB
420/XXX
VT 1822Z AUG 1988
HI LVL SIG WX
400-70MB PROG
N54B 516

FIGURE 132C.—High-Level Significant Weather Chart.

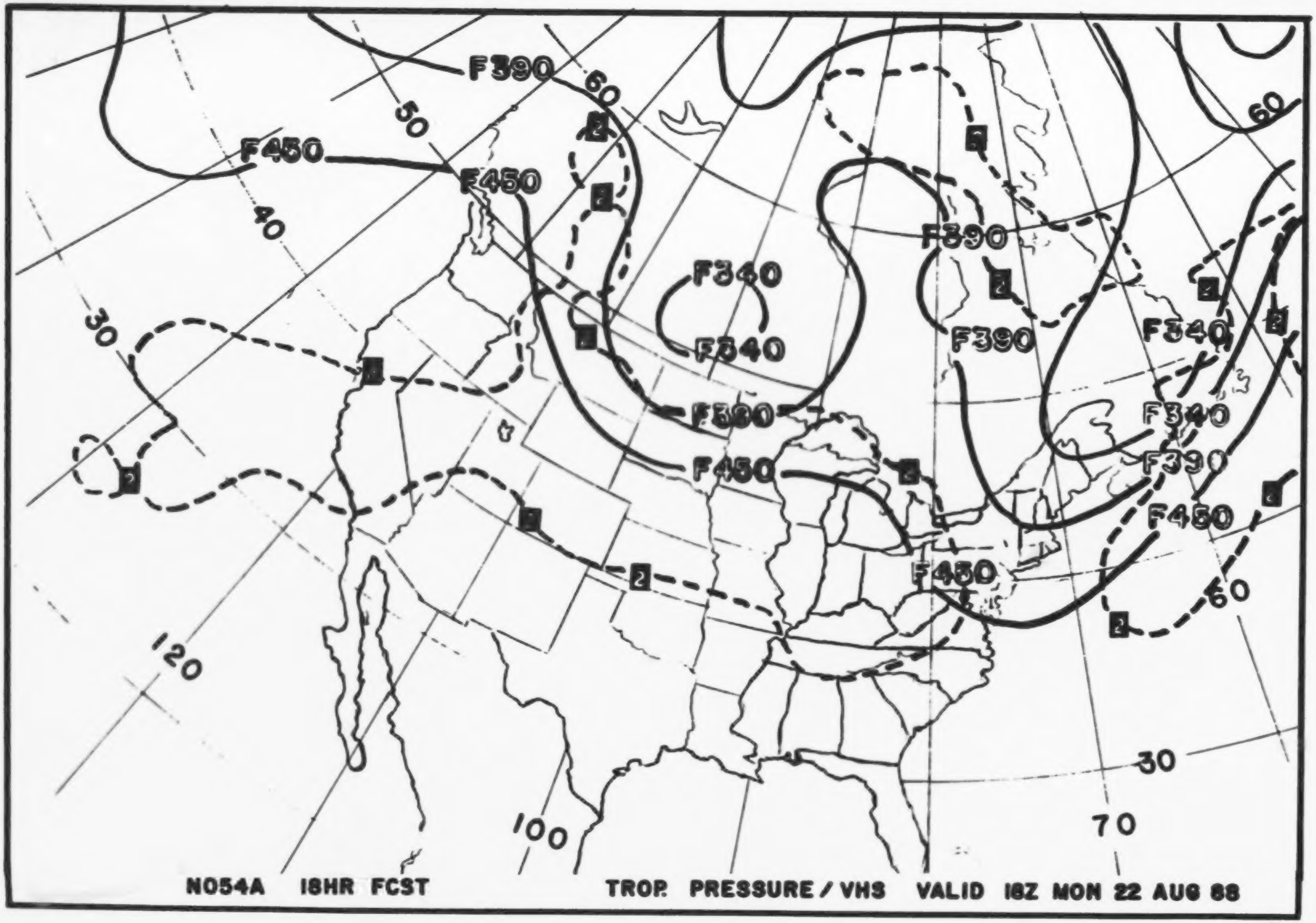

F390
60
50
F450
F450
40
2
F340
F340
F390
F390
F390
60
30
F380
F450
F450
F340
F340
F390
F450
60
120
100
70
30
N054A 18HR FCST
TROP. PRESSURE / VHS VALID 18Z MON 22 AUG 88

FIGURE 132D.—Tropopause Pressure/VHS.

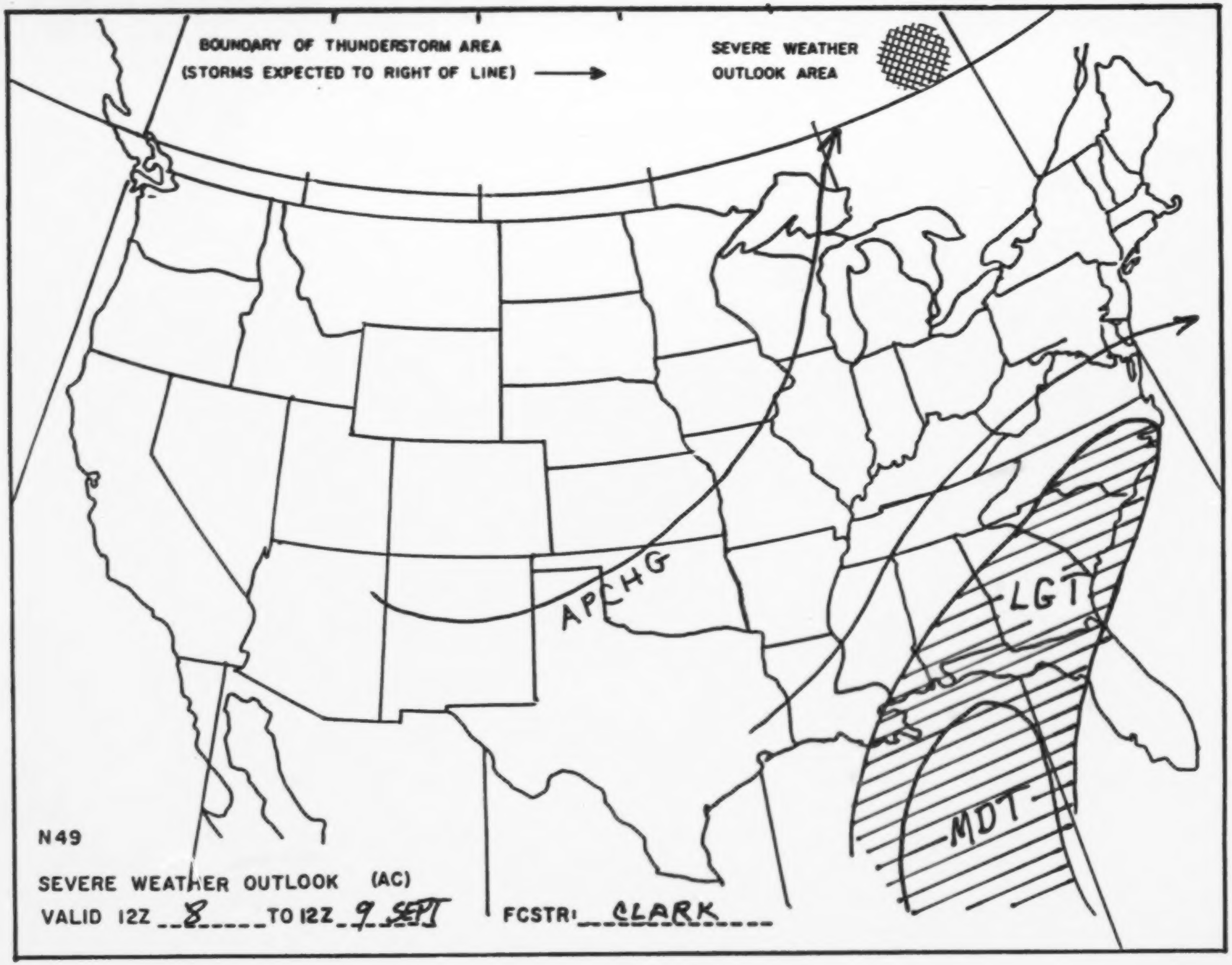

BOUNDARY OF THUNDERSTORM AREA
(STORMS EXPECTED TO RIGHT OF LINE) →
SEVERE WEATHER OUTLOOK AREA
APCHG
LGT
MDT
N49
SEVERE WEATHER OUTLOOK (AC)
VALID 12Z 8 TO 12Z 9 SEPT
FCSTR: CLARK

FIGURE 133A.—Severe Weather Outlook (AC).

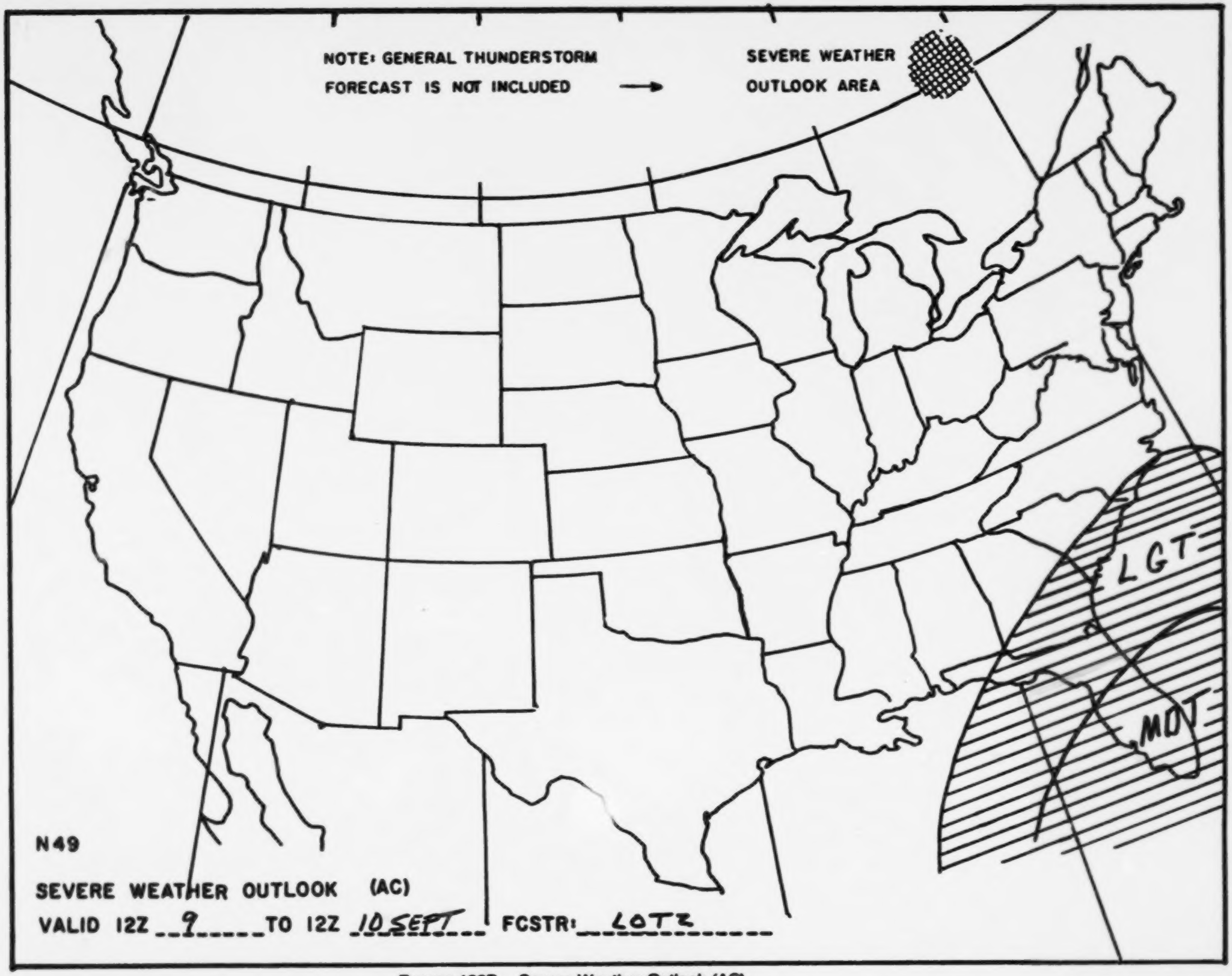

NOTE: GENERAL THUNDERSTORM FORECAST IS NOT INCLUDED →
SEVERE WEATHER OUTLOOK AREA
LGT
MDT
N49
SEVERE WEATHER OUTLOOK (AC)
VALID 12Z 9 TO 12Z 10 SEPT FCSTR: LOTZ

FIGURE 133B.—Severe Weather Outlook (AC).

## STARS, JULY—DEC., 1978

| No. | Name | | Mag. | S.H.A. | Dec. |
|---|---|---|---|---|---|
| | | | | ° ′ | ° ′ |
| 7* | *Acamar* | | 3·1 | 315 35 | S. 40 23 |
| 5* | *Achernar* | | 0·6 | 335 46 | S. 57 21 |
| 30* | *Acrux* | | 1·1 | 173 39 | S. 62 59 |
| 19 | *Adhara* | † | 1·6 | 255 33 | S. 28 57 |
| 10* | *Aldebaran* | † | 1·1 | 291 19 | N. 16 28 |
| 32* | *Alioth* | | 1·7 | 166 44 | N. 56 05 |
| 34* | *Alkaid* | | 1·9 | 153 20 | N. 49 25 |
| 55 | *Al Na'ir* | | 2·2 | 28 16 | S. 47 04 |
| 15 | *Alnilam* | † | 1·8 | 276 13 | S. 1 13 |
| 25* | *Alphard* | † | 2·2 | 218 22 | S. 8 34 |
| 41* | *Alphecca* | † | 2·3 | 126 33 | N. 26 47 |
| 1* | *Alpheratz* | † | 2·2 | 358 10 | N. 28 58 |
| 51* | *Altair* | † | 0·9 | 62 34 | N. 8 49 |
| 2 | *Ankaa* | | 2·4 | 353 41 | S. 42 25 |
| 42* | *Antares* | † | 1·2 | 112 59 | S. 26 23 |
| 37* | *Arcturus* | † | 0·2 | 146 20 | N. 19 18 |
| 43 | *Atria* | | 1·9 | 108 24 | S. 68 59 |
| 22 | *Avior* | | 1·7 | 234 29 | S. 59 26 |
| 13 | *Bellatrix* | † | 1·7 | 279 00 | N. 6 20 |
| 16* | *Betelgeuse* | † | 0·1–1·2 | 271 30 | N. 7 24 |
| 17* | *Canopus* | | −0·9 | 264 08 | S. 52 41 |
| 12* | *Capella* | | 0·2 | 281 13 | N. 45 58 |
| 53* | *Deneb* | | 1·3 | 49 49 | N. 45 13 |
| 28* | *Denebola* | † | 2·2 | 183 01 | N. 14 42 |
| 4* | *Diphda* | † | 2·2 | 349 22 | S. 18 06 |
| 27* | *Dubhe* | | 2·0 | 194 24 | N. 61 52 |
| 14 | *Elnath* | † | 1·8 | 278 46 | N. 28 35 |
| 47 | *Eltanin* | | 2·4 | 90 58 | N. 51 30 |
| 54* | *Enif* | † | 2·5 | 34 13 | N. 9 47 |
| 56* | *Fomalhaut* | † | 1·3 | 15 53 | S. 29 44 |
| 31 | *Gacrux* | | 1·6 | 172 30 | S. 57 00 |
| 29* | *Gienah* | † | 2·8 | 176 20 | S. 17 25 |
| 35 | *Hadar* | | 0·9 | 149 25 | S. 60 16 |
| 6* | *Hamal* | † | 2·2 | 328 30 | N. 23 22 |
| 48 | *Kaus Aust.* | | 2·0 | 84 19 | S. 34 24 |
| 40* | *Kochab* | | 2·2 | 137 20 | N. 74 15 |
| 57 | *Markab* | † | 2·6 | 14 04 | N. 15 06 |
| 8* | *Menkar* | † | 2·8 | 314 42 | N. 4 00 |
| 36 | *Menkent* | | 2·3 | 148 39 | S. 36 16 |
| 24* | *Miaplacidus* | | 1·8 | 221 45 | S. 69 38 |
| 9* | *Mirfak* | | 1·9 | 309 18 | N. 49 47 |
| 50* | *Nunki* | † | 2·1 | 76 31 | S. 26 19 |
| 52* | *Peacock* | | 2·1 | 54 00 | S. 56 48 |
| 21* | *Pollux* | † | 1·2 | 244 00 | N. 28 05 |
| 20* | *Procyon* | † | 0·5 | 245 27 | N. 5 17 |
| 46* | *Rasalhague* | † | 2·1 | 96 31 | N. 12 35 |
| 26* | *Regulus* | † | 1·3 | 208 12 | N. 12 04 |
| 11* | *Rigel* | † | 0·3 | 281 37 | S. 8 14 |
| 38* | *Rigil Kent.* | | 0·1 | 140 28 | S. 60 45 |
| 44 | *Sabik* | † | 2·6 | 102 43 | S. 15 42 |
| 3* | *Schedar* | | 2·5 | 350 10 | N. 56 25 |
| 45* | *Shaula* | | 1·7 | 96 58 | S. 37 05 |
| 18* | *Sirius* | † | −1·6 | 258 57 | S. 16 41 |
| 33* | *Spica* | † | 1·2 | 158 59 | S. 11 03 |
| 23* | *Suhail* | | 2·2 | 223 12 | S. 43 21 |
| 49* | *Vega* | | 0·1 | 80 57 | N. 38 46 |
| 39 | *Zuben'ubi* | † | 2·9 | 137 35 | S. 15 57 |

## INTERPOLATION OF G.H.A.

Increment to be added for intervals of G.M.T. to G.H.A. of: Sun, Aries (♈) and planets; Moon

| SUN, etc. | | MOON | SUN, etc. | | MOON | SUN, etc. | | MOON |
|---|---|---|---|---|---|---|---|---|
| m s | ° ′ | m s | m s | ° ′ | m s | m s | ° ′ | m s |
| 00 00 | | 00 00 | 03 17 | | 03 25 | 06 37 | | 06 52 |
| | 0 00 | | | 0 50 | | | 1 40 | |
| 01 | | 00 02 | 21 | | 03 29 | 41 | | 06 56 |
| | 0 01 | | | 0 51 | | | 1 41 | |
| 05 | | 00 06 | 25 | | 03 33 | 45 | | 07 00 |
| | 0 02 | | | 0 52 | | | 1 42 | |
| 09 | | 00 10 | 29 | | 03 37 | 49 | | 07 04 |
| | 0 03 | | | 0 53 | | | 1 43 | |
| 13 | | 00 14 | 33 | | 03 41 | 53 | | 07 08 |
| | 0 04 | | | 0 54 | | | 1 44 | |
| 17 | | 00 18 | 37 | | 03 45 | 06 57 | | 07 13 |
| | 0 05 | | | 0 55 | | | 1 45 | |
| 21 | | 00 22 | 41 | | 03 49 | 07 01 | | 07 17 |
| | 0 06 | | | 0 56 | | | 1 46 | |
| 25 | | 00 26 | 45 | | 03 54 | 05 | | 07 21 |
| | 0 07 | | | 0 57 | | | 1 47 | |
| 29 | | 00 31 | 49 | | 03 58 | 09 | | 07 25 |
| | 0 08 | | | 0 58 | | | 1 48 | |
| 33 | | 00 35 | 53 | | 04 02 | 13 | | 07 29 |
| | 0 09 | | | 0 59 | | | 1 49 | |
| 37 | | 00 39 | 03 57 | | 04 06 | 17 | | 07 33 |
| | 0 10 | | | 1 00 | | | 1 50 | |
| 41 | | 00 43 | 04 01 | | 04 10 | 21 | | 07 37 |
| | 0 11 | | | 1 01 | | | 1 51 | |
| 45 | | 00 47 | 05 | | 04 14 | 25 | | 07 42 |
| | 0 12 | | | 1 02 | | | 1 52 | |
| 49 | | 00 51 | 09 | | 04 19 | 29 | | 07 46 |
| | 0 13 | | | 1 03 | | | 1 53 | |
| 53 | | 00 55 | 13 | | 04 23 | 33 | | 07 50 |
| | 0 14 | | | 1 04 | | | 1 54 | |
| 00 57 | | 01 00 | 17 | | 04 27 | 37 | | 07 54 |
| | 0 15 | | | 1 05 | | | 1 55 | |
| 01 01 | | 01 04 | 21 | | 04 31 | 41 | | 07 58 |
| | 0 16 | | | 1 06 | | | 1 56 | |
| 05 | | 01 08 | 25 | | 04 35 | 45 | | 08 02 |
| | 0 17 | | | 1 07 | | | 1 57 | |
| 09 | | 01 12 | 29 | | 04 39 | 49 | | 08 06 |
| | 0 18 | | | 1 08 | | | 1 58 | |
| 13 | | 01 16 | 33 | | 04 43 | 53 | | 08 11 |
| | 0 19 | | | 1 09 | | | 1 59 | |
| 17 | | 01 20 | 37 | | 04 48 | 07 57 | | 08 15 |
| | 0 20 | | | 1 10 | | | 2 00 | |
| 21 | | 01 24 | 41 | | 04 52 | 08 01 | | 08 19 |
| | 0 21 | | | 1 11 | | | 2 01 | |
| 25 | | 01 29 | 45 | | 04 56 | 05 | | 08 23 |
| | 0 22 | | | 1 12 | | | 2 02 | |
| 29 | | 01 33 | 49 | | 05 00 | 09 | | 08 27 |
| | 0 23 | | | 1 13 | | | 2 03 | |
| 33 | | 01 37 | 53 | | 05 04 | 13 | | 08 31 |
| | 0 24 | | | 1 14 | | | 2 04 | |
| 37 | | 01 41 | 04 57 | | 05 08 | 17 | | 08 35 |
| | 0 25 | | | 1 15 | | | 2 05 | |
| 41 | | 01 45 | 05 01 | | 05 12 | 21 | | 08 40 |
| | 0 26 | | | 1 16 | | | 2 06 | |
| 45 | | 01 49 | 05 | | 05 17 | 25 | | 08 44 |
| | 0 27 | | | 1 17 | | | 2 07 | |
| 49 | | 01 53 | 09 | | 05 21 | 29 | | 08 48 |
| | 0 28 | | | 1 18 | | | 2 08 | |
| 53 | | 01 58 | 13 | | 05 25 | 33 | | 08 52 |
| | 0 29 | | | 1 19 | | | 2 09 | |
| 01 57 | | 02 02 | 17 | | 05 29 | 37 | | 08 56 |
| | 0 30 | | | 1 20 | | | 2 10 | |
| 02 01 | | 02 06 | 21 | | 05 33 | 41 | | 09 00 |
| | 0 31 | | | 1 21 | | | 2 11 | |
| 05 | | 02 10 | 25 | | 05 37 | 45 | | 09 04 |
| | 0 32 | | | 1 22 | | | 2 12 | |
| 09 | | 02 14 | 29 | | 05 41 | 49 | | 09 09 |
| | 0 33 | | | 1 23 | | | 2 13 | |
| 13 | | 02 18 | 33 | | 05 46 | 53 | | 09 13 |
| | 0 34 | | | 1 24 | | | 2 14 | |
| 17 | | 02 22 | 37 | | 05 50 | 08 57 | | 09 17 |
| | 0 35 | | | 1 25 | | | 2 15 | |
| 21 | | 02 27 | 41 | | 05 54 | 09 01 | | 09 21 |
| | 0 36 | | | 1 26 | | | 2 16 | |
| 25 | | 02 31 | 45 | | 05 58 | 05 | | 09 25 |
| | 0 37 | | | 1 27 | | | 2 17 | |
| 29 | | 02 35 | 49 | | 06 02 | 09 | | 09 29 |
| | 0 38 | | | 1 28 | | | 2 18 | |
| 33 | | 02 39 | 53 | | 06 06 | 13 | | 09 33 |
| | 0 39 | | | 1 29 | | | 2 19 | |
| 37 | | 02 43 | 05 57 | | 06 10 | 17 | | 09 38 |
| | 0 40 | | | 1 30 | | | 2 20 | |
| 41 | | 02 47 | 06 01 | | 06 15 | 21 | | 09 42 |
| | 0 41 | | | 1 31 | | | 2 21 | |
| 45 | | 02 51 | 05 | | 06 19 | 25 | | 09 46 |
| | 0 42 | | | 1 32 | | | 2 22 | |
| 49 | | 02 56 | 09 | | 06 23 | 29 | | 09 50 |
| | 0 43 | | | 1 33 | | | 2 23 | |
| 53 | | 03 00 | 13 | | 06 27 | 33 | | 09 54 |
| | 0 44 | | | 1 34 | | | 2 24 | |
| 02 57 | | 03 04 | 17 | | 06 31 | 37 | | 09 58 |
| | 0 45 | | | 1 35 | | | 2 25 | |
| 03 01 | | 03 08 | 21 | | 06 35 | 41 | | 10 00 |
| | 0 46 | | | 1 36 | | | 2 26 | |
| 05 | | 03 12 | 25 | | 06 39 | 45 | | |
| | 0 47 | | | 1 37 | | | 2 27 | |
| 09 | | 03 16 | 29 | | 06 44 | 49 | | |
| | 0 48 | | | 1 38 | | | 2 28 | |
| 13 | | 03 20 | 33 | | 06 48 | 53 | | |
| | 0 49 | | | 1 39 | | | 2 29 | |
| 17 | | 03 25 | 37 | | 06 52 | 09 57 | | |
| | 0 50 | | | 1 40 | | | 2 30 | |
| 03 21 | | 03 29 | 06 41 | | 06 56 | 10 00 | | |

*Stars used in H.O. 249 (A.P. 3270) Vol. 1.

†Stars that may be used with Vols. 2 and 3.

FIGURE 134.—STARS, July - December.

## (DAY 262) GREENWICH P. M. 1978 SEPTEMBER 19 (TUESDAY)

| GMT | ☉ SUN GHA | ☉ SUN Dec. | ARIES GHA ♈ | VENUS −4.2 GHA | VENUS −4.2 Dec. | JUPITER −1.5 GHA | JUPITER −1.5 Dec. | SATURN 1.0 GHA | SATURN 1.0 Dec. | ◑ MOON GHA | ◑ MOON Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| h m | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ |
| 12 00 | 1 31.8 | N 1 30.8 | 178 02.2 | 321 44 | S19 07 | 53 07 | N19 51 | 18 54 | N10 23 | 147 51 | N 9 07 |
| 10 | 4 01.8 | 30.6 | 180 32.7 | 324 14 |  | 55 37 |  | 21 25 |  | 150 16 | 08 |
| 20 | 6 31.9 | 30.4 | 183 03.1 | 326 44 |  | 58 08 |  | 23 55 |  | 152 41 | 10 |
| 30 | 9 01.9 | · 30.3 | 185 33.5 | 329 14 | · · | 60 38 | · · | 26 25 | · · | 155 06 | · 11 |
| 40 | 11 31.9 | 30.1 | 188 03.9 | 331 44 |  | 63 08 |  | 28 56 |  | 157 30 | 13 |
| 50 | 14 02.0 | 30.0 | 190 34.3 | 334 14 |  | 65 39 |  | 31 26 |  | 159 55 | 14 |
| 13 00 | 16 32.0 | N 1 29.8 | 193 04.7 | 336 45 | S19 08 | 68 09 | N19 51 | 33 56 | N10 23 | 162 20 | N 9 16 |
| 10 | 19 02.1 | 29.6 | 195 35.1 | 339 15 |  | 70 39 |  | 36 27 |  | 164 45 | 17 |
| 20 | 21 32.1 | 29.5 | 198 05.5 | 341 45 |  | 73 10 |  | 38 57 |  | 167 10 | 19 |
| 30 | 24 02.1 | · 29.3 | 200 35.9 | 344 15 | · · | 75 40 | · · | 41 27 | · · | 169 35 | · 20 |
| 40 | 26 32.2 | 29.2 | 203 06.4 | 346 45 |  | 78 10 |  | 43 58 |  | 172 00 | 22 |
| 50 | 29 02.2 | 29.0 | 205 36.8 | 349 15 |  | 80 41 |  | 46 28 |  | 174 25 | 23 |
| 14 00 | 31 32.2 | N 1 28.8 | 208 07.2 | 351 45 | S19 09 | 83 11 | N19 51 | 48 59 | N10 23 | 176 50 | N 9 25 |
| 10 | 34 02.3 | 28.7 | 210 37.6 | 354 15 |  | 85 41 |  | 51 29 |  | 179 15 | 26 |
| 20 | 36 32.3 | 28.5 | 213 08.0 | 356 45 |  | 88 12 |  | 53 59 |  | 181 40 | 28 |
| 30 | 39 02.4 | · 28.3 | 215 38.4 | 359 16 | · · | 90 42 | · · | 56 30 | · · | 184 05 | · 29 |
| 40 | 41 32.4 | 28.2 | 218 08.8 | 1 46 |  | 93 12 |  | 59 00 |  | 186 30 | 31 |
| 50 | 44 02.4 | 28.0 | 220 39.2 | 4 16 |  | 95 43 |  | 61 30 |  | 188 55 | 32 |
| 15 00 | 46 32.5 | N 1 27.9 | 223 09.6 | 6 46 | S19 10 | 98 13 | N19 51 | 64 01 | N10 23 | 191 20 | N 9 34 |
| 10 | 49 02.5 | 27.7 | 225 40.1 | 9 16 |  | 100 43 |  | 66 31 |  | 193 45 | 35 |
| 20 | 51 32.5 | 27.5 | 228 10.5 | 11 46 |  | 103 14 |  | 69 01 |  | 196 10 | 37 |
| 30 | 54 02.6 | · 27.4 | 230 40.9 | 14 16 | · · | 105 44 | · · | 71 32 | · · | 198 35 | · 38 |
| 40 | 56 32.6 | 27.2 | 233 11.3 | 16 46 |  | 108 14 |  | 74 02 |  | 201 00 | 40 |
| 50 | 59 02.7 | 27.1 | 235 41.7 | 19 16 |  | 110 45 |  | 76 33 |  | 203 25 | 41 |
| 16 00 | 61 32.7 | N 1 26.9 | 238 12.1 | 21 47 | S19 11 | 113 15 | N19 51 | 79 03 | N10 23 | 205 49 | N 9 43 |
| 10 | 64 02.7 | 26.7 | 240 42.5 | 24 17 |  | 115 45 |  | 81 33 |  | 208 14 | 44 |
| 20 | 66 32.8 | 26.6 | 243 12.9 | 26 47 |  | 118 16 |  | 84 04 |  | 210 39 | 46 |
| 30 | 69 02.8 | · 26.4 | 245 43.3 | 29 17 | · · | 120 46 | · · | 86 34 | · · | 213 04 | · 47 |
| 40 | 71 32.8 | 26.2 | 248 13.7 | 31 47 |  | 123 16 |  | 89 04 |  | 215 29 | 49 |
| 50 | 74 02.9 | 26.1 | 250 44.2 | 34 17 |  | 125 47 |  | 91 35 |  | 217 54 | 50 |
| 17 00 | 76 32.9 | N 1 25.9 | 253 14.6 | 36 47 | S19 12 | 128 17 | N19 51 | 94 05 | N10 22 | 220 19 | N 9 52 |
| 10 | 79 03.0 | 25.8 | 255 45.0 | 39 17 |  | 130 47 |  | 96 35 |  | 222 44 | 53 |
| 20 | 81 33.0 | 25.6 | 258 15.4 | 41 47 |  | 133 18 |  | 99 06 |  | 225 09 | 55 |
| 30 | 84 03.0 | · 25.4 | 260 45.8 | 44 18 | · · | 135 48 | · · | 101 36 | · · | 227 34 | · 56 |
| 40 | 86 33.1 | 25.3 | 263 16.2 | 46 48 |  | 138 18 |  | 104 06 |  | 229 59 | 58 |
| 50 | 89 03.1 | 25.1 | 265 46.6 | 49 18 |  | 140 49 |  | 106 37 |  | 232 24 | 9 59 |
| 18 00 | 91 33.1 | N 1 25.0 | 268 17.0 | 51 48 | S19 12 | 143 19 | N19 51 | 109 07 | N10 22 | 234 49 | N10 01 |
| 10 | 94 03.2 | 24.8 | 270 47.4 | 54 18 |  | 145 49 |  | 111 38 |  | 237 14 | 02 |
| 20 | 96 33.2 | 24.6 | 273 17.9 | 56 48 |  | 148 20 |  | 114 08 |  | 239 39 | 04 |
| 30 | 99 03.2 | · 24.5 | 275 48.3 | 59 18 | · · | 150 50 | · · | 116 38 | · · | 242 04 | · 05 |
| 40 | 101 33.3 | 24.3 | 278 18.7 | 61 48 |  | 153 20 |  | 119 09 |  | 244 29 | 06 |
| 50 | 104 03.3 | 24.1 | 280 49.1 | 64 18 |  | 155 51 |  | 121 39 |  | 246 54 | 08 |
| 19 00 | 106 33.4 | N 1 24.0 | 283 19.5 | 66 49 | S19 13 | 158 21 | N19 51 | 124 09 | N10 22 | 249 19 | N10 09 |
| 10 | 109 03.4 | 23.8 | 285 49.9 | 69 19 |  | 160 51 |  | 126 40 |  | 251 44 | 11 |
| 20 | 111 33.4 | 23.7 | 288 20.3 | 71 49 |  | 163 22 |  | 129 10 |  | 254 09 | 12 |
| 30 | 114 03.5 | · 23.5 | 290 50.7 | 74 19 | · · | 165 52 | · · | 131 41 | · · | 256 34 | · 14 |
| 40 | 116 33.5 | 23.3 | 293 21.1 | 76 49 |  | 168 22 |  | 134 11 |  | 258 59 | 15 |
| 50 | 119 03.5 | 23.2 | 295 51.6 | 79 19 |  | 170 53 |  | 136 41 |  | 261 24 | 17 |
| 20 00 | 121 33.6 | N 1 23.0 | 298 22.0 | 81 49 | S19 14 | 173 23 | N19 50 | 139 12 | N10 22 | 263 48 | N10 18 |
| 10 | 124 03.6 | 22.8 | 300 52.4 | 84 19 |  | 175 53 |  | 141 42 |  | 266 13 | 19 |
| 20 | 126 33.7 | 22.7 | 303 22.8 | 86 50 |  | 178 24 |  | 144 12 |  | 268 38 | 21 |
| 30 | 129 03.7 | · 22.5 | 305 53.2 | 89 20 | · · | 180 54 | · · | 146 43 | · · | 271 03 | · 22 |
| 40 | 131 33.7 | 22.4 | 308 23.6 | 91 50 |  | 183 25 |  | 149 13 |  | 273 28 | 24 |
| 50 | 134 03.8 | 22.2 | 310 54.0 | 94 20 |  | 185 55 |  | 151 43 |  | 275 53 | 25 |
| 21 00 | 136 33.8 | N 1 22.0 | 313 24.4 | 96 50 | S19 15 | 188 25 | N19 50 | 154 14 | N10 22 | 278 18 | N10 27 |
| 10 | 139 03.8 | 21.9 | 315 54.8 | 99 20 |  | 190 56 |  | 156 44 |  | 280 43 | 28 |
| 20 | 141 33.9 | 21.7 | 318 25.2 | 101 50 |  | 193 26 |  | 159 14 |  | 283 08 | 29 |
| 30 | 144 03.9 | · 21.6 | 320 55.7 | 104 20 | · · | 195 56 | · · | 161 45 | · · | 285 33 | · 31 |
| 40 | 146 34.0 | 21.4 | 323 26.1 | 106 50 |  | 198 27 |  | 164 15 |  | 287 58 | 32 |
| 50 | 149 04.0 | 21.2 | 325 56.5 | 109 21 |  | 200 57 |  | 166 46 |  | 290 23 | 34 |
| 22 00 | 151 34.0 | N 1 21.1 | 328 26.9 | 111 51 | S19 16 | 203 27 | N19 50 | 169 16 | N10 22 | 292 48 | N10 35 |
| 10 | 154 04.1 | 20.9 | 330 57.3 | 114 21 |  | 205 58 |  | 171 46 |  | 295 13 | 37 |
| 20 | 156 34.1 | 20.7 | 333 27.7 | 116 51 |  | 208 28 |  | 174 17 |  | 297 38 | 38 |
| 30 | 159 04.1 | · 20.6 | 335 58.1 | 119 21 | · · | 210 58 | · · | 176 47 | · · | 300 03 | · 39 |
| 40 | 161 34.2 | 20.4 | 338 28.5 | 121 51 |  | 213 29 |  | 179 17 |  | 302 28 | 41 |
| 50 | 164 04.2 | 20.3 | 340 58.9 | 124 21 |  | 215 59 |  | 181 48 |  | 304 53 | 42 |
| 23 00 | 166 34.2 | N 1 20.1 | 343 29.4 | 126 51 | S19 17 | 218 29 | N19 50 | 184 18 | N10 22 | 307 18 | N10 44 |
| 10 | 169 04.3 | 19.9 | 345 59.8 | 129 21 |  | 221 00 |  | 186 48 |  | 309 43 | 45 |
| 20 | 171 34.3 | 19.8 | 348 30.2 | 131 52 |  | 223 30 |  | 189 19 |  | 312 08 | 46 |
| 30 | 174 04.4 | · 19.6 | 351 00.6 | 134 22 | · · | 226 00 | · · | 191 49 | · · | 314 33 | · 48 |
| 40 | 176 34.4 | 19.5 | 353 31.0 | 136 52 |  | 228 31 |  | 194 20 |  | 316 58 | 49 |
| 50 | 179 04.4 | 19.3 | 356 01.4 | 139 22 |  | 231 01 |  | 196 50 |  | 319 23 | 51 |
| Rate | 15 00.2 | S0 01.0 |  | 15 00.7 | S0 00.9 | 15 02.0 | S0 00.1 | 15 02.2 | S0 00.1 | 14 29.8 | N0 08.8 |

| Lat. | Moonset | Diff. |
|---|---|---|
| N |  |  |
| ° | h m | m |
| 72 | 09 56 | 55 |
| 70 | 09 42 | 51 |
| 68 | 09 31 | 48 |
| 66 | 09 22 | 45 |
| 64 | 09 15 | 43 |
| 62 | 09 08 | 42 |
| 60 | 09 03 | 40 |
| 58 | 08 58 | 39 |
| 56 | 08 53 | 38 |
| 54 | 08 49 | 37 |
| 52 | 08 46 | 36 |
| 50 | 08 43 | 35 |
| 45 | 08 36 | 34 |
| 40 | 08 30 | 32 |
| 35 | 08 25 | 31 |
| 30 | 08 20 | 30 |
| 20 | 08 13 | 28 |
| 10 | 08 06 | 27 |
| 0 | 08 00 | 25 |
| 10 | 07 54 | 24 |
| 20 | 07 47 | 22 |
| 30 | 07 40 | 21 |
| 35 | 07 35 | 20 |
| 40 | 07 30 | 19 |
| 45 | 07 25 | 17 |
| 50 | 07 18 | 15 |
| 52 | 07 15 | 15 |
| 54 | 07 11 | 14 |
| 56 | 07 08 | 13 |
| 58 | 07 03 | 12 |
| 60 | 06 59 | 11 |
| S |  |  |

**Moon's P. in A.**

| Alt. | Corr. | Alt. | Corr. |
|---|---|---|---|
| ° | ′ | ° | ′ |
| 0 | 57 | 55 | 32 |
| 10 | 56 | 56 | 31 |
| 15 | 55 | 57 | 30 |
| 18 | 54 | 59 | 29 |
| 21 | 53 | 60 | 28 |
| 23 | 52 | 61 | 27 |
| 26 | 51 | 62 | 26 |
| 28 | 50 | 63 | 25 |
| 30 | 49 | 64 | 24 |
| 32 | 48 | 65 | 23 |
| 34 | 47 | 66 | 22 |
| 35 | 46 | 68 | 21 |
| 37 | 45 | 69 | 20 |
| 39 | 44 | 70 | 19 |
| 40 | 43 | 71 | 18 |
| 42 | 42 | 72 | 17 |
| 43 | 41 | 73 | 16 |
| 45 | 40 | 74 | 15 |
| 46 | 39 | 75 | 14 |
| 47 | 38 | 76 | 13 |
| 49 | 37 | 77 | 12 |
| 50 | 36 | 78 | 11 |
| 51 | 35 | 79 | 10 |
| 53 | 34 | 80 |  |
| 54 | 33 |  |  |
| 55 | 32 |  |  |
| 56 |  |  |  |

Sun SD 15′.9
Moon SD 16′
Age 17d

FIGURE 135.—Greenwich Day 262.

# (DAY 263) GREENWICH A. M. 1978 SEPTEMBER 20 (WEDNESDAY)

| GMT | ☉ SUN | | ARIES | VENUS−4.2 | | JUPITER−1.5 | | SATURN 1.0 | | ○ MOON | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | GHA | Dec. | GHA ♈ | GHA | Dec. | GHA | Dec. | GHA | Dec. | GHA | Dec. |
| h m | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ |
| 00 00 | 181 34.5 | N 1 19.1 | 358 31.8 | 141 52 | S19 18 | 233 31 | N19 50 | 199 20 | N10 22 | 321 48 | N10 52 |
| 10 | 184 04.5 | 19.0 | 1 02.2 | 144 22 | | 236 02 | | 201 51 | | 324 13 | 53 |
| 20 | 186 34.5 | 18.8 | 3 32.6 | 146 52 | | 238 32 | | 204 21 | | 326 38 | 55 |
| 30 | 189 04.6 | · 18.6 | 6 03.1 | 149 22 | · · | 241 02 | · · | 206 51 | · · | 329 03 | · 56 |
| 40 | 191 34.6 | 18.5 | 8 33.5 | 151 52 | | 243 33 | | 209 22 | | 331 28 | 58 |
| 50 | 194 04.7 | 18.3 | 11 03.9 | 154 23 | | 246 03 | | 211 52 | | 333 53 | 10 59 |
| 01 00 | 196 34.7 | N 1 18.2 | 13 34.3 | 156 53 | S19 18 | 248 33 | N19 50 | 214 22 | N10 22 | 336 18 | N11 00 |
| 10 | 199 04.7 | 18.0 | 16 04.7 | 159 23 | | 251 04 | | 216 53 | | 338 42 | 02 |
| 20 | 201 34.8 | 17.9 | 18 35.1 | 161 53 | | 253 34 | | 219 23 | | 341 07 | 03 |
| 30 | 204 04.8 | · 17.7 | 21 05.5 | 164 23 | · · | 256 04 | · · | 221 54 | · · | 343 32 | · 05 |
| 40 | 206 34.8 | 17.5 | 23 35.9 | 166 53 | | 258 35 | | 224 24 | | 345 57 | 06 |
| 50 | 209 04.9 | 17.4 | 26 06.3 | 169 23 | | 261 05 | | 226 54 | | 348 22 | 07 |
| 02 00 | 211 34.9 | N 1 17.2 | 28 36.7 | 171 53 | S19 19 | 263 35 | N19 50 | 229 25 | N10 21 | 350 47 | N11 09 |
| 10 | 214 05.0 | 17.0 | 31 07.2 | 174 24 | | 266 06 | | 231 55 | | 353 12 | 10 |
| 20 | 216 35.0 | 16.9 | 33 37.6 | 176 54 | | 268 36 | | 234 25 | | 355 37 | 11 |
| 30 | 219 05.0 | · 16.7 | 36 08.0 | 179 24 | · · | 271 06 | · · | 236 56 | · · | 358 02 | · 13 |
| 40 | 221 35.1 | 16.5 | 38 38.4 | 181 54 | | 273 37 | | 239 26 | | 0 27 | 14 |
| 50 | 224 05.1 | 16.4 | 41 08.8 | 184 24 | | 276 07 | | 241 56 | | 2 52 | 16 |
| 03 00 | 226 35.1 | N 1 16.2 | 43 39.2 | 186 54 | S19 20 | 278 37 | N19 50 | 244 27 | N10 21 | 5 17 | N11 17 |
| 10 | 229 05.2 | 16.1 | 46 09.6 | 189 24 | | 281 08 | | 246 57 | | 7 42 | 18 |
| 20 | 231 35.2 | 15.9 | 48 40.0 | 191 54 | | 283 38 | | 249 28 | | 10 07 | 20 |
| 30 | 234 05.3 | · 15.7 | 51 10.4 | 194 24 | · · | 286 08 | · · | 251 58 | · · | 12 32 | · 21 |
| 40 | 236 35.3 | 15.6 | 53 40.9 | 196 55 | | 288 39 | | 254 28 | | 14 57 | 22 |
| 50 | 239 05.3 | 15.4 | 56 11.3 | 199 25 | | 291 09 | | 256 59 | | 17 22 | 24 |
| 04 00 | 241 35.4 | N 1 15.3 | 58 41.7 | 201 55 | S19 21 | 293 39 | N19 50 | 259 29 | N10 21 | 19 47 | N11 25 |
| 10 | 244 05.4 | 15.1 | 61 12.1 | 204 25 | | 296 10 | | 261 59 | | 22 12 | 26 |
| 20 | 246 35.4 | 14.9 | 63 42.5 | 206 55 | | 298 40 | | 264 30 | | 24 37 | 28 |
| 30 | 249 05.5 | · 14.8 | 66 12.9 | 209 25 | · · | 301 10 | · · | 267 00 | · · | 27 02 | · 29 |
| 40 | 251 35.5 | 14.6 | 68 43.3 | 211 55 | | 303 41 | | 269 30 | | 29 27 | 30 |
| 50 | 254 05.5 | 14.4 | 71 13.7 | 214 25 | | 306 11 | | 272 01 | | 31 52 | 32 |
| 05 00 | 256 35.6 | N 1 14.3 | 73 44.1 | 216 56 | S19 22 | 308 41 | N19 50 | 274 31 | N10 21 | 34 17 | N11 33 |
| 10 | 259 05.6 | 14.1 | 76 14.5 | 219 26 | | 311 12 | | 277 01 | | 36 42 | 34 |
| 20 | 261 35.7 | 14.0 | 78 45.0 | 221 56 | | 313 42 | | 279 32 | | 39 07 | 36 |
| 30 | 264 05.7 | · 13.8 | 81 15.4 | 224 26 | · · | 316 12 | · · | 282 02 | · · | 41 32 | · 37 |
| 40 | 266 35.7 | 13.6 | 83 45.8 | 226 56 | | 318 43 | | 284 33 | | 43 57 | 38 |
| 50 | 269 05.8 | 13.5 | 86 16.2 | 229 26 | | 321 13 | | 287 03 | | 46 22 | 40 |
| 06 00 | 271 35.8 | N 1 13.3 | 88 46.6 | 231 56 | S19 23 | 323 43 | N19 50 | 289 33 | N10 21 | 48 47 | N11 41 |
| 10 | 274 05.8 | 13.1 | 91 17.0 | 234 26 | | 326 14 | | 292 04 | | 51 12 | 42 |
| 20 | 276 35.9 | 13.0 | 93 47.4 | 236 56 | | 328 44 | | 294 34 | | 53 37 | 44 |
| 30 | 279 05.9 | · 12.8 | 96 17.8 | 239 27 | · · | 331 14 | · · | 297 04 | · · | 56 02 | · 45 |
| 40 | 281 36.0 | 12.7 | 98 48.2 | 241 57 | | 333 45 | | 299 35 | | 58 27 | 46 |
| 50 | 284 06.0 | 12.5 | 101 18.7 | 244 27 | | 336 15 | | 302 05 | | 60 52 | 48 |
| 07 00 | 286 36.0 | N 1 12.3 | 103 49.1 | 246 57 | S19 24 | 338 45 | N19 49 | 304 36 | N10 21 | 63 17 | N11 49 |
| 10 | 289 06.1 | 12.2 | 106 19.5 | 249 27 | | 341 16 | | 307 06 | | 65 42 | 50 |
| 20 | 291 36.1 | 12.0 | 108 49.9 | 251 57 | | 343 46 | | 309 36 | | 68 07 | 52 |
| 30 | 294 06.1 | · 11.9 | 111 20.3 | 254 27 | · · | 346 16 | · · | 312 07 | · · | 70 32 | · 53 |
| 40 | 296 36.2 | 11.7 | 113 50.7 | 256 57 | | 348 47 | | 314 37 | | 72 57 | 54 |
| 50 | 299 06.2 | 11.5 | 116 21.1 | 259 27 | | 351 17 | | 317 07 | | 75 22 | 55 |
| 08 00 | 301 36.3 | N 1 11.4 | 118 51.5 | 261 58 | S19 24 | 353 47 | N19 49 | 319 38 | N10 21 | 77 47 | N11 57 |
| 10 | 304 06.3 | 11.2 | 121 21.9 | 264 28 | | 356 18 | | 322 08 | | 80 12 | 58 |
| 20 | 306 36.3 | 11.0 | 123 52.4 | 266 58 | | 358 48 | | 324 38 | | 82 37 | 11 59 |
| 30 | 309 06.4 | · 10.9 | 126 22.8 | 269 28 | · · | 1 18 | · · | 327 09 | · · | 85 02 | 12 01 |
| 40 | 311 36.4 | 10.7 | 128 53.2 | 271 58 | | 3 49 | | 329 39 | | 87 27 | 02 |
| 50 | 314 06.4 | 10.6 | 131 23.6 | 274 28 | | 6 19 | | 332 09 | | 89 52 | 03 |
| 09 00 | 316 36.5 | N 1 10.4 | 133 54.0 | 276 58 | S19 25 | 8 49 | N19 49 | 334 40 | N10 21 | 92 17 | N12 05 |
| 10 | 319 06.5 | 10.2 | 136 24.4 | 279 28 | | 11 20 | | 337 10 | | 94 42 | 06 |
| 20 | 321 36.5 | 10.1 | 138 54.8 | 281 59 | | 13 50 | | 339 41 | | 97 07 | 07 |
| 30 | 324 06.6 | · 09.9 | 141 25.2 | 284 29 | · · | 16 20 | · · | 342 11 | · · | 99 32 | · 08 |
| 40 | 326 36.6 | 09.8 | 143 55.6 | 286 59 | | 18 51 | | 344 41 | | 101 57 | 10 |
| 50 | 329 06.7 | 09.6 | 146 26.0 | 289 29 | | 21 21 | | 347 12 | | 104 22 | 11 |
| 10 00 | 331 36.7 | N 1 09.4 | 148 56.5 | 291 59 | S19 26 | 23 51 | N19 49 | 349 42 | N10 21 | 106 47 | N12 12 |
| 10 | 334 06.7 | 09.3 | 151 26.9 | 294 29 | | 26 22 | | 352 12 | | 109 12 | 14 |
| 20 | 336 36.8 | 09.1 | 153 57.3 | 296 59 | | 28 52 | | 354 43 | | 111 37 | 15 |
| 30 | 339 06.8 | · 08.9 | 156 27.7 | 299 29 | · · | 31 22 | · · | 357 13 | · · | 114 02 | · 16 |
| 40 | 341 36.8 | 08.8 | 158 58.1 | 301 59 | | 33 53 | | 359 43 | | 116 27 | 17 |
| 50 | 344 06.9 | 08.6 | 161 28.5 | 304 30 | | 36 23 | | 2 14 | | 118 52 | 19 |
| 11 00 | 346 36.9 | N 1 08.5 | 163 58.9 | 307 00 | S19 27 | 38 54 | N19 49 | 4 44 | N10 20 | 121 17 | N12 20 |
| 10 | 349 07.0 | 08.3 | 166 29.3 | 309 30 | | 41 24 | | 7 15 | | 123 41 | 21 |
| 20 | 351 37.0 | 08.1 | 168 59.7 | 312 00 | | 43 54 | | 9 45 | | 126 06 | 22 |
| 30 | 354 07.0 | · 08.0 | 171 30.2 | 314 30 | · · | 46 25 | · · | 12 15 | · · | 128 31 | · 24 |
| 40 | 356 37.1 | 07.8 | 174 00.6 | 317 00 | | 48 55 | | 14 46 | | 130 56 | 25 |
| 50 | 359 07.1 | 07.6 | 176 31.0 | 319 30 | | 51 25 | | 17 16 | | 133 21 | 26 |
| Rate | 15 00.2 | S0 01.0 | | 15 00.7 | S0 00.9 | 15 02.0 | S0 00.1 | 15 02.2 | S0 00.1 | 14 29.9 | N0 08.0 |

| Lat. | Moon-rise | Diff. |
|---|---|---|
| N | | |
| ° | h m | m |
| 72 | 18 07 | −02 |
| 70 | 18 31 | +03 |
| 68 | 18 49 | 06 |
| 66 | 19 04 | 09 |
| 64 | 19 17 | 11 |
| 62 | 19 27 | 12 |
| 60 | 19 36 | 13 |
| 58 | 19 44 | 14 |
| 56 | 19 51 | 15 |
| 54 | 19 57 | 16 |
| 52 | 20 03 | 17 |
| 50 | 20 08 | 17 |
| 45 | 20 19 | 19 |
| 40 | 20 28 | 20 |
| 35 | 20 36 | 21 |
| 30 | 20 43 | 21 |
| 20 | 20 55 | 23 |
| 10 | 21 06 | 24 |
| 0 | 21 16 | 25 |
| 10 | 21 26 | 26 |
| 20 | 21 37 | 27 |
| 30 | 21 49 | 29 |
| 35 | 21 56 | 29 |
| 40 | 22 05 | 30 |
| 45 | 22 14 | 31 |
| 50 | 22 26 | 33 |
| 52 | 22 31 | 33 |
| 54 | 22 37 | 34 |
| 56 | 22 44 | 34 |
| 58 | 22 52 | 36 |
| 60 | 23 00 | 36 |
| S | | |

Moon's P. in A.

| Alt. | Corr. | Alt. | Corr. |
|---|---|---|---|
| ° | +′ | ° | +′ |
| 0 | 57 | 55 | 32 |
| 7 | 56 | 56 | 31 |
| 13 | 55 | 57 | 30 |
| 17 | 54 | 58 | 29 |
| 20 | 53 | 60 | 28 |
| 23 | 52 | 61 | 27 |
| 25 | 51 | 62 | 26 |
| 27 | 50 | 63 | 25 |
| 29 | 49 | 64 | 24 |
| 31 | 48 | 65 | 23 |
| 33 | 47 | 66 | 22 |
| 35 | 46 | 67 | 21 |
| 37 | 45 | 68 | 20 |
| 38 | 44 | 70 | 19 |
| 40 | 43 | 71 | 18 |
| 41 | 42 | 72 | 17 |
| 43 | 41 | 73 | 16 |
| 44 | 40 | 74 | 15 |
| 46 | 39 | 75 | 14 |
| 47 | 38 | 76 | 13 |
| 48 | 37 | 77 | 12 |
| 50 | 36 | 78 | 11 |
| 51 | 35 | 79 | 10 |
| 52 | 34 | 80 | |
| 54 | 33 | | |
| 55 | 32 | | |
| 56 | | | |

Sun SD 16.′0
Moon SD 16′
Age 18d

FIGURE 136.—Greenwich Day 263.

## (DAY 263) GREENWICH P. M. 1978 SEPTEMBER 20 (WEDNESDAY)

| GMT | ☉ SUN | | ARIES | VENUS–4.2 | | JUPITER–1.5 | | SATURN 1.0 | | ☽ MOON | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | GHA | Dec. | GHA ♈ | GHA | Dec. | GHA | Dec. | GHA | Dec. | GHA | Dec. |
| h m | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ |
| 12 00 | 1 37.1 | N 1 07.5 | 179 01.4 | 322 00 | S19 28 | 53 56 | N19 49 | 19 46 | N10 20 | 135 46 | N12 27 |
| 10 | 4 07.2 | 07.3 | 181 31.8 | 324 31 | | 56 26 | | 22 17 | | 138 11 | 29 |
| 20 | 6 37.2 | 07.2 | 184 02.2 | 327 01 | | 58 56 | | 24 47 | | 140 36 | 30 |
| 30 | 9 07.3 | · 07.0 | 186 32.6 | 329 31 | · · | 61 27 | · · | 27 17 | · · | 143 01 | · 31 |
| 40 | 11 37.3 | 06.8 | 189 03.0 | 332 01 | | 63 57 | | 29 48 | | 145 26 | 32 |
| 50 | 14 07.3 | 06.7 | 191 33.4 | 334 31 | | 66 27 | | 32 18 | | 147 51 | 34 |
| 13 00 | 16 37.4 | N 1 06.5 | 194 03.9 | 337 01 | S19 29 | 68 58 | N19 49 | 34 49 | N10 20 | 150 16 | N12 35 |
| 10 | 19 07.4 | 06.4 | 196 34.3 | 339 31 | | 71 28 | | 37 19 | | 152 41 | 36 |
| 20 | 21 37.4 | 06.2 | 199 04.7 | 342 01 | | 73 58 | | 39 49 | | 155 06 | 37 |
| 30 | 24 07.5 | · 06.0 | 201 35.1 | 344 31 | · · | 76 29 | · · | 42 20 | · · | 157 31 | · 39 |
| 40 | 26 37.5 | 05.9 | 204 05.5 | 347 02 | | 78 59 | | 44 50 | | 159 56 | 40 |
| 50 | 29 07.5 | 05.7 | 206 35.9 | 349 32 | | 81 29 | | 47 20 | | 162 21 | 41 |
| 14 00 | 31 37.6 | N 1 05.5 | 209 06.3 | 352 02 | S19 29 | 84 00 | N19 49 | 49 51 | N10 20 | 164 46 | N12 42 |
| 10 | 34 07.6 | 05.4 | 211 36.7 | 354 32 | | 86 30 | | 52 21 | | 167 11 | 44 |
| 20 | 36 37.7 | 05.2 | 214 07.1 | 357 02 | | 89 00 | | 54 51 | | 169 36 | 45 |
| 30 | 39 07.7 | · 05.1 | 216 37.5 | 359 32 | · · | 91 31 | · · | 57 22 | · · | 172 01 | · 46 |
| 40 | 41 37.7 | 04.9 | 219 08.0 | 2 02 | | 94 01 | | 59 52 | | 174 26 | 47 |
| 50 | 44 07.8 | 04.7 | 221 38.4 | 4 32 | | 96 31 | | 62 23 | | 176 51 | 48 |
| 15 00 | 46 37.8 | N 1 04.6 | 224 08.8 | 7 03 | S19 30 | 99 02 | N19 49 | 64 53 | N10 20 | 179 16 | N12 50 |
| 10 | 49 07.8 | 04.4 | 226 39.2 | 9 33 | | 101 32 | | 67 23 | | 181 41 | 51 |
| 20 | 51 37.9 | 04.3 | 229 09.6 | 12 03 | | 104 02 | | 69 54 | | 184 06 | 52 |
| 30 | 54 07.9 | · 04.1 | 231 40.0 | 14 33 | · · | 106 33 | · · | 72 24 | · · | 186 31 | · 53 |
| 40 | 56 38.0 | 03.9 | 234 10.4 | 17 03 | | 109 03 | | 74 54 | | 188 56 | 54 |
| 50 | 59 08.0 | 03.8 | 236 40.8 | 19 33 | | 111 33 | | 77 25 | | 191 21 | 56 |
| 16 00 | 61 38.0 | N 1 03.6 | 239 11.2 | 22 03 | S19 31 | 114 04 | N19 49 | 79 55 | N10 20 | 193 46 | N12 57 |
| 10 | 64 08.1 | 03.4 | 241 41.7 | 24 33 | | 116 34 | | 82 25 | | 196 11 | 58 |
| 20 | 66 38.1 | 03.3 | 244 12.1 | 27 04 | | 119 04 | | 84 56 | | 198 36 | 12 59 |
| 30 | 69 08.1 | · 03.1 | 246 42.5 | 29 34 | · · | 121 35 | · · | 87 26 | · · | 201 01 | · 13 01 |
| 40 | 71 38.2 | 03.0 | 249 12.9 | 32 04 | | 124 05 | | 89 57 | | 203 26 | 02 |
| 50 | 74 08.2 | 02.8 | 251 43.3 | 34 34 | | 126 35 | | 92 27 | | 205 51 | 03 |
| 17 00 | 76 38.3 | N 1 02.6 | 254 13.7 | 37 04 | S19 32 | 129 06 | N19 48 | 94 57 | N10 20 | 208 16 | N13 04 |
| 10 | 79 08.3 | 02.5 | 256 44.1 | 39 34 | | 131 36 | | 97 28 | | 210 41 | 05 |
| 20 | 81 38.3 | 02.3 | 259 14.5 | 42 04 | | 134 06 | | 99 58 | | 213 06 | 06 |
| 30 | 84 08.4 | · 02.1 | 261 44.9 | 44 34 | · · | 136 37 | · · | 102 28 | · · | 215 31 | · 08 |
| 40 | 86 38.4 | 02.0 | 264 15.3 | 47 04 | | 139 07 | | 104 59 | | 217 56 | 09 |
| 50 | 89 08.4 | 01.8 | 266 45.8 | 49 35 | | 141 37 | | 107 29 | | 220 21 | 10 |
| 18 00 | 91 38.5 | N 1 01.7 | 269 16.2 | 52 05 | S19 33 | 144 08 | N19 48 | 109 59 | N10 20 | 222 46 | N13 11 |
| 10 | 94 08.5 | 01.5 | 271 46.6 | 54 35 | | 146 38 | | 112 30 | | 225 11 | 12 |
| 20 | 96 38.5 | 01.3 | 274 17.0 | 57 05 | | 149 08 | | 115 00 | | 227 36 | 14 |
| 30 | 99 08.6 | · 01.2 | 276 47.4 | 59 35 | · · | 151 39 | · · | 117 31 | · · | 230 01 | · 15 |
| 40 | 101 38.6 | 01.0 | 279 17.8 | 62 05 | | 154 09 | | 120 01 | | 232 26 | 16 |
| 50 | 104 08.7 | 00.9 | 281 48.2 | 64 35 | | 156 39 | | 122 31 | | 234 51 | 17 |
| 19 00 | 106 38.7 | N 1 00.7 | 284 18.6 | 67 05 | S19 34 | 159 10 | N19 48 | 125 02 | N10 20 | 237 16 | N13 18 |
| 10 | 109 08.7 | 00.5 | 286 49.0 | 69 36 | | 161 40 | | 127 32 | | 239 41 | 19 |
| 20 | 111 38.8 | 00.4 | 289 19.5 | 72 06 | | 164 10 | | 130 02 | | 242 06 | 21 |
| 30 | 114 08.8 | · 00.2 | 291 49.9 | 74 36 | · · | 166 41 | · · | 132 33 | · · | 244 31 | · 22 |
| 40 | 116 38.8 | 1 00.0 | 294 20.3 | 77 06 | | 169 11 | | 135 03 | | 246 56 | 23 |
| 50 | 119 08.9 | 0 59.9 | 296 50.7 | 79 36 | | 171 41 | | 137 33 | | 249 21 | 24 |
| 20 00 | 121 38.9 | N 0 59.7 | 299 21.1 | 82 06 | S19 34 | 174 12 | N19 48 | 140 04 | N10 19 | 251 46 | N13 25 |
| 10 | 124 09.0 | 59.6 | 301 51.5 | 84 36 | | 176 42 | | 142 34 | | 254 11 | 26 |
| 20 | 126 39.0 | 59.4 | 304 21.9 | 87 06 | | 179 12 | | 145 05 | | 256 36 | 27 |
| 30 | 129 09.0 | · 59.2 | 306 52.3 | 89 36 | · · | 181 43 | · · | 147 35 | · · | 259 01 | · 29 |
| 40 | 131 39.1 | 59.1 | 309 22.7 | 92 07 | | 184 13 | | 150 05 | | 261 26 | 30 |
| 50 | 134 09.1 | 58.9 | 311 53.2 | 94 37 | | 186 43 | | 152 36 | | 263 52 | 31 |
| 21 00 | 136 39.1 | N 0 58.7 | 314 23.6 | 97 07 | S19 35 | 189 14 | N19 48 | 155 06 | N10 19 | 266 17 | N13 32 |
| 10 | 139 09.2 | 58.6 | 316 54.0 | 99 37 | | 191 44 | | 157 36 | | 268 42 | 33 |
| 20 | 141 39.2 | 58.4 | 319 24.4 | 102 07 | | 194 14 | | 160 07 | | 271 07 | 34 |
| 30 | 144 09.2 | · 58.3 | 321 54.8 | 104 37 | · · | 196 45 | · · | 162 37 | · · | 273 32 | · 35 |
| 40 | 146 39.3 | 58.1 | 324 25.2 | 107 07 | | 199 15 | | 165 07 | | 275 57 | 37 |
| 50 | 149 09.3 | 57.9 | 326 55.6 | 109 37 | | 201 45 | | 167 38 | | 278 22 | 38 |
| 22 00 | 151 39.4 | N 0 57.8 | 329 26.0 | 112 08 | S19 36 | 204 16 | N19 48 | 170 08 | N10 19 | 280 47 | N13 39 |
| 10 | 154 09.4 | 57.6 | 331 56.4 | 114 38 | | 206 46 | | 172 38 | | 283 12 | 40 |
| 20 | 156 39.4 | 57.5 | 334 26.8 | 117 08 | | 209 16 | | 175 09 | | 285 37 | 41 |
| 30 | 159 09.5 | · 57.3 | 336 57.3 | 119 38 | · · | 211 47 | · · | 177 39 | · · | 288 02 | · 42 |
| 40 | 161 39.5 | 57.1 | 339 27.7 | 122 08 | | 214 17 | | 180 10 | | 290 27 | 43 |
| 50 | 164 09.5 | 57.0 | 341 58.1 | 124 38 | | 216 47 | | 182 40 | | 292 52 | 44 |
| 23 00 | 166 39.6 | N 0 56.8 | 344 28.5 | 127 08 | S19 37 | 219 13 | N19 48 | 185 10 | N10 19 | 295 17 | N13 46 |
| 10 | 169 09.6 | 56.6 | 346 58.9 | 129 38 | | 221 48 | | 187 41 | | 297 42 | 47 |
| 20 | 171 39.7 | 56.5 | 349 29.3 | 132 09 | | 224 18 | | 190 11 | | 300 07 | 48 |
| 30 | 174 09.7 | · 56.3 | 351 59.7 | 134 39 | · · | 226 49 | · · | 192 41 | · · | 302 32 | · 49 |
| 40 | 176 39.7 | 56.2 | 354 30.1 | 137 09 | | 229 19 | | 195 12 | | 304 57 | 50 |
| 50 | 179 09.8 | 56.0 | 357 00.5 | 139 39 | | 231 49 | | 197 42 | | 307 22 | 51 |
| Rate | 15 00.2 | S0 01.0 | | 15 00.7 | S0 00.8 | 15 02.0 | S0 00.1 | 15 02.2 | S0 00.1 | 14 30.8 | N0 07.1 |

| Lat | Moon-set | Diff |
|---|---|---|
| N | | |
| ° | h m | m |
| 72 | 11 45 | 54 |
| 70 | 11 22 | 49 |
| 68 | 11 04 | 45 |
| 66 | 10 50 | 43 |
| 64 | 10 39 | 41 |
| 62 | 10 29 | 39 |
| 60 | 10 21 | 38 |
| 58 | 10 13 | 37 |
| 56 | 10 07 | 36 |
| 54 | 10 01 | 35 |
| 52 | 09 56 | 34 |
| 50 | 09 51 | 33 |
| 45 | 09 41 | 32 |
| 40 | 09 33 | 31 |
| 35 | 09 26 | 30 |
| 30 | 09 19 | 29 |
| 20 | 09 09 | 28 |
| 10 | 08 59 | 26 |
| 0 | 08 50 | 25 |
| 10 | 08 41 | 24 |
| 20 | 08 32 | 23 |
| 30 | 08 21 | 21 |
| 35 | 08 15 | 20 |
| 40 | 08 08 | 19 |
| 45 | 07 59 | 18 |
| 50 | 07 49 | 17 |
| 52 | 07 45 | 16 |
| 54 | 07 40 | 15 |
| 56 | 07 34 | 14 |
| 58 | 07 28 | 14 |
| 60 | 07 21 | 12 |
| S | | |

Moon's P. in A.

| Alt. | Corr | Alt. | Corr |
|---|---|---|---|
| ° | ′ | ° | ′ |
| 0 | 57 | 54 | 32 |
| 3 | 56 | 56 | 31 |
| 11 | 55 | 57 | 30 |
| 15 | 54 | 58 | 29 |
| 19 | 53 | 59 | 28 |
| 22 | 52 | 60 | 27 |
| 24 | 51 | 62 | 26 |
| 26 | 50 | 63 | 25 |
| 29 | 49 | 64 | 24 |
| 31 | 48 | 65 | 23 |
| 32 | 47 | 66 | 22 |
| 34 | 46 | 67 | 21 |
| 36 | 45 | 68 | 20 |
| 38 | 44 | 69 | 19 |
| 39 | 43 | 70 | 18 |
| 41 | 42 | 71 | 17 |
| 42 | 41 | 73 | 16 |
| 44 | 40 | 74 | 15 |
| 45 | 39 | 75 | 14 |
| 47 | 38 | 76 | 13 |
| 48 | 37 | 77 | 12 |
| 49 | 36 | 78 | 11 |
| 51 | 35 | 79 | 10 |
| 52 | 34 | 80 | |
| 53 | 33 | | |
| 54 | 32 | | |
| 56 | | | |

Sun SD 16′.0
Moon SD 15′
Age 18d

FIGURE 137.—Greenwich Day 263.

## *POLARIS* (POLE STAR) TABLE, 1978

### FOR DETERMINING THE LATITUDE FROM A SEXTANT ALTITUDE

| L.H.A. ♈ | Q | L.H.A. ♈ | Q | L.H.A. ♈ | Q | L.H.A. ♈ | Q | L.H.A. ♈ | Q | L.H.A. ♈ | Q | L.H.A. ♈ | Q | L.H.A. ♈ | Q |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ° ′ | ′ | ° ′ | ′ | ° ′ | ′ | ° ′ | ′ | ° ′ | ′ | ° ′ | ′ | ° ′ | ′ | ° ′ | ′ |
| 359 06 | | 81 54 | | 114 52 | | 145 20 | | 188 06 | | 268 21 | | 300 18 | | 331 10 | |
| | -42 | | -32 | | - 6 | | +20 | | +46 | | +28 | | + 2 | | -24 |
| 1 12 | | 83 23 | | 116 01 | | 146 35 | | 191 03 | | 269 44 | | 301 27 | | 332 28 | |
| | -43 | | -31 | | - 5 | | +21 | | +47 | | +27 | | + 1 | | -25 |
| 3 26 | | 84 50 | | 117 10 | | 147 51 | | 194 26 | | 271 06 | | 302 36 | | 333 47 | |
| | -44 | | -30 | | - 4 | | +22 | | +48 | | +26 | | 0 | | -26 |
| 5 50 | | 86 16 | | 118 19 | | 149 08 | | 198 36 | | 272 27 | | 303 45 | | 335 07 | |
| | -45 | | -29 | | - 3 | | +23 | | +49 | | +25 | | - 1 | | -27 |
| 8 27 | | 87 40 | | 119 28 | | 150 26 | | 204 36 | | 273 46 | | 304 54 | | 336 29 | |
| | -46 | | -28 | | - 2 | | +24 | | +50 | | +24 | | - 2 | | -28 |
| 11 21 | | 89 02 | | 120 37 | | 151 45 | | 220 55 | | 275 05 | | 306 03 | | 337 51 | |
| | -47 | | -27 | | - 1 | | +25 | | +49 | | +23 | | - 3 | | -29 |
| 14 42 | | 90 24 | | 121 46 | | 153 04 | | 226 55 | | 276 23 | | 307 12 | | 339 15 | |
| | -48 | | -26 | | 0 | | +26 | | +48 | | +22 | | - 4 | | -30 |
| 18 48 | | 91 44 | | 122 55 | | 154 25 | | 231 05 | | 277 40 | | 308 21 | | 340 41 | |
| | -49 | | -25 | | + 1 | | +27 | | +47 | | +21 | | - 5 | | -31 |
| 24 43 | | 93 03 | | 124 04 | | 155 47 | | 234 28 | | 278 56 | | 309 30 | | 342 08 | |
| | -50 | | -24 | | + 2 | | +28 | | +46 | | +20 | | - 6 | | -32 |
| 40 48 | | 94 21 | | 125 13 | | 157 10 | | 237 25 | | 280 11 | | 310 39 | | 343 37 | |
| | -49 | | -23 | | + 3 | | +29 | | +45 | | +19 | | - 7 | | -33 |
| 46 43 | | 95 38 | | 126 22 | | 158 35 | | 240 04 | | 281 25 | | 311 48 | | 345 08 | |
| | -48 | | -22 | | + 4 | | +30 | | +44 | | +18 | | - 8 | | -34 |
| 50 49 | | 96 54 | | 127 31 | | 160 01 | | 242 30 | | 282 39 | | 312 58 | | 346 42 | |
| | -47 | | -21 | | + 5 | | +31 | | +43 | | +17 | | - 9 | | -35 |
| 54 10 | | 98 10 | | 128 40 | | 161 29 | | 244 46 | | 283 53 | | 314 08 | | 348 18 | |
| | -46 | | -20 | | + 6 | | +32 | | +42 | | +16 | | -10 | | -36 |
| 57 04 | | 99 25 | | 129 49 | | 162 59 | | 246 53 | | 285 05 | | 315 18 | | 349 56 | |
| | -45 | | -19 | | + 7 | | +33 | | +41 | | +15 | | -11 | | -37 |
| 59 41 | | 100 39 | | 130 58 | | 164 31 | | 248 54 | | 286 18 | | 316 28 | | 351 38 | |
| | -44 | | -18 | | + 8 | | +34 | | +40 | | +14 | | -12 | | -38 |
| 62 05 | | 101 52 | | 132 08 | | 166 06 | | 250 49 | | 287 29 | | 317 39 | | 353 23 | |
| | -43 | | -17 | | + 9 | | +35 | | +39 | | +13 | | -13 | | -39 |
| 64 19 | | 103 05 | | 133 19 | | 167 42 | | 252 40 | | 288 41 | | 318 50 | | 355 12 | |
| | -42 | | -16 | | +10 | | +36 | | +38 | | +12 | | -14 | | -40 |
| 66 25 | | 104 18 | | 134 29 | | 169 22 | | 254 26 | | 289 52 | | 320 01 | | 357 06 | |
| | -41 | | -15 | | +11 | | +37 | | +37 | | +11 | | -15 | | -41 |
| 68 25 | | 105 30 | | 135 39 | | 171 05 | | 256 08 | | 291 02 | | 321 13 | | 359 06 | |
| | -40 | | -14 | | +12 | | +38 | | +36 | | +10 | | -16 | | -42 |
| 70 19 | | 106 41 | | 136 50 | | 172 51 | | 257 48 | | 292 12 | | 322 26 | | 1 12 | |
| | -39 | | -13 | | +13 | | +39 | | +35 | | + 9 | | -17 | | -43 |
| 72 08 | | 107 52 | | 138 02 | | 174 42 | | 259 25 | | 293 22 | | 323 39 | | 3 26 | |
| | -38 | | -12 | | +14 | | +40 | | +34 | | + 8 | | -18 | | -44 |
| 73 53 | | 109 03 | | 139 13 | | 176 37 | | 261 00 | | 294 32 | | 324 52 | | 5 50 | |
| | -37 | | -11 | | +15 | | +41 | | +33 | | + 7 | | -19 | | -45 |
| 75 35 | | 110 13 | | 140 26 | | 178 38 | | 262 32 | | 295 42 | | 326 06 | | 8 27 | |
| | -36 | | -10 | | +16 | | +42 | | +32 | | + 6 | | -20 | | -46 |
| 77 13 | | 111 23 | | 141 38 | | 180 45 | | 264 02 | | 296 51 | | 327 21 | | 11 21 | |
| | -35 | | - 9 | | +17 | | +43 | | +31 | | + 5 | | -21 | | -47 |
| 78 49 | | 112 33 | | 142 52 | | 183 01 | | 265 30 | | 298 00 | | 328 37 | | 14 42 | |
| | -34 | | - 8 | | +18 | | +44 | | +30 | | + 4 | | -22 | | -48 |
| 80 23 | | 113 43 | | 144 06 | | 185 27 | | 266 56 | | 299 09 | | 329 53 | | 18 48 | |
| | -33 | | - 7 | | +19 | | +45 | | +29 | | + 3 | | -23 | | -49 |
| 81 54 | | 114 52 | | 145 20 | | 188 06 | | 268 21 | | 300 18 | | 331 10 | | 24 43 | |

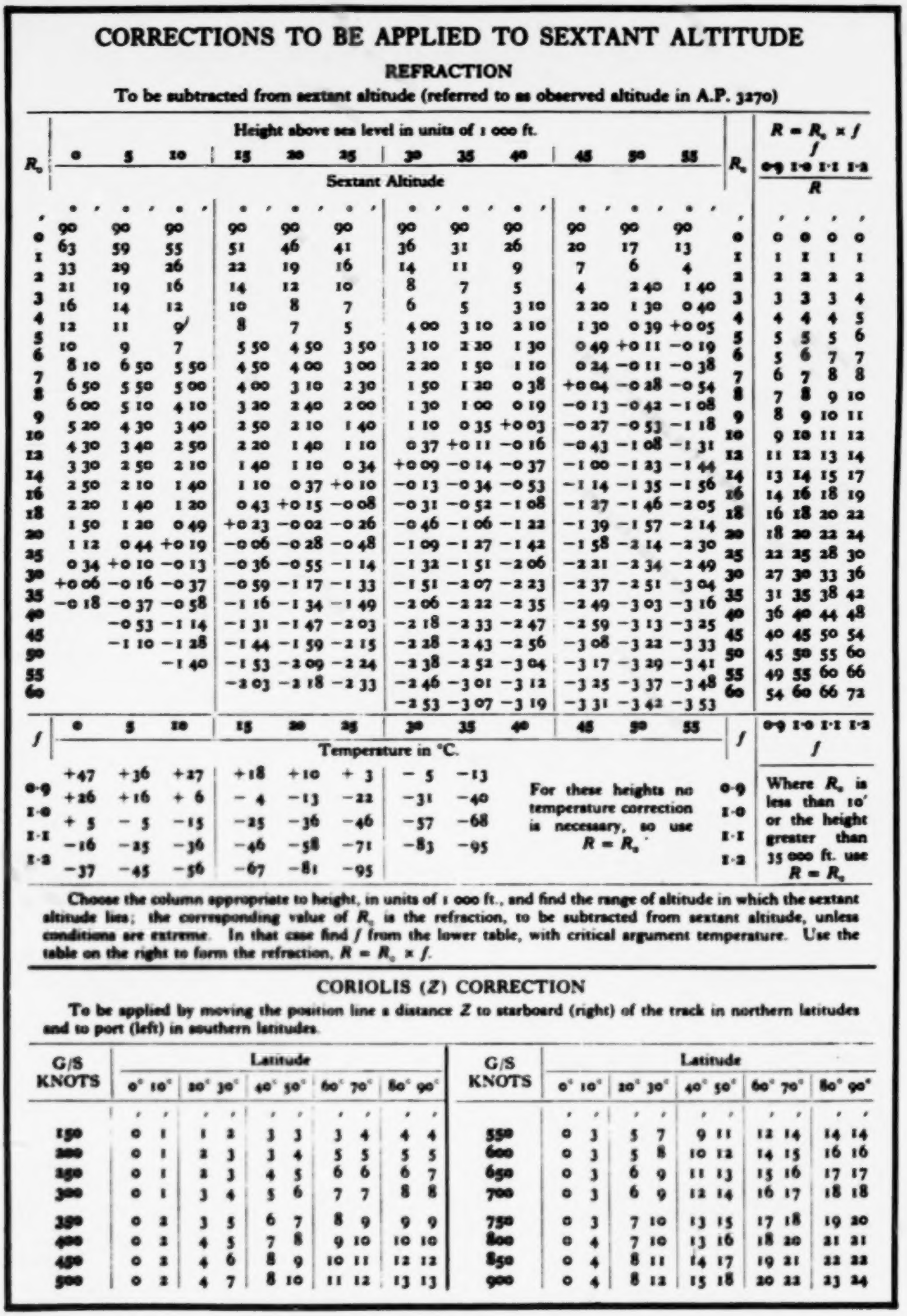
*Q*, which does *not* include refraction, is to be applied to the corrected sextant altitude of *Polaris*.
*Polaris*: Mag. 2·1, S.H.A. 327°14′, Dec. N. 89°10·′0

### AZIMUTH OF *POLARIS*

| L.H.A. ♈ | Latitude | | | | | | | L.H.A. ♈ | Latitude | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0° | 30° | 50° | 55° | 60° | 65° | 70° | | 0° | 30° | 50° | 55° | 60° | 65° | 70° |
| ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° |
| 0 | 0·5 | 0·5 | 0·7 | 0·8 | 0·9 | 1·1 | 1·4 | 180 | 359·5 | 359·5 | 359·3 | 359·2 | 359·1 | 359·0 | 358·7 |
| 10 | 0·3 | 0·4 | 0·5 | 0·6 | 0·7 | 0·8 | 1·0 | 190 | 359·7 | 359·6 | 359·5 | 359·4 | 359·4 | 359·3 | 359·1 |
| 20 | 0·2 | 0·2 | 0·3 | 0·3 | 0·4 | 0·4 | 0·6 | 200 | 359·8 | 359·8 | 359·7 | 359·7 | 359·6 | 359·6 | 359·5 |
| 30 | 0·0 | 0·0 | 0·1 | 0·1 | 0·1 | 0·1 | 0·1 | 210 | 0·0 | 0·0 | 359·9 | 359·9 | 359·9 | 359·9 | 359·9 |
| 40 | 359·9 | 359·9 | 359·8 | 359·8 | 359·8 | 359·7 | 359·7 | 220 | 0·1 | 0·1 | 0·2 | 0·2 | 0·2 | 0·2 | 0·3 |
| 50 | 359·8 | 359·7 | 359·6 | 359·6 | 359·5 | 359·4 | 359·3 | 230 | 0·2 | 0·3 | 0·4 | 0·4 | 0·5 | 0·6 | 0·7 |
| 60 | 359·6 | 359·6 | 359·4 | 359·3 | 359·2 | 359·1 | 358·8 | 240 | 0·4 | 0·4 | 0·6 | 0·7 | 0·7 | 0·9 | 1·1 |
| 70 | 359·5 | 359·4 | 359·2 | 359·1 | 359·0 | 358·8 | 358·5 | 250 | 0·5 | 0·6 | 0·8 | 0·9 | 1·0 | 1·2 | 1·4 |
| 80 | 359·4 | 359·3 | 359·0 | 358·9 | 358·8 | 358·5 | 358·2 | 260 | 0·6 | 0·7 | 0·9 | 1·1 | 1·2 | 1·4 | 1·7 |
| 90 | 359·3 | 359·2 | 358·9 | 358·8 | 358·6 | 358·3 | 357·9 | 270 | 0·7 | 0·8 | 1·1 | 1·2 | 1·4 | 1·6 | 2·0 |
| 100 | 359·2 | 359·1 | 358·8 | 358·6 | 358·4 | 358·2 | 357·7 | 280 | 0·8 | 0·9 | 1·2 | 1·3 | 1·5 | 1·8 | 2·2 |
| 110 | 359·2 | 359·1 | 358·7 | 358·6 | 358·4 | 358·1 | 357·6 | 290 | 0·8 | 0·9 | 1·3 | 1·4 | 1·6 | 1·9 | 2·4 |
| 120 | 359·2 | 359·0 | 358·7 | 358·5 | 358·3 | 358·0 | 357·6 | 300 | 0·8 | 1·0 | 1·3 | 1·4 | 1·7 | 2·0 | 2·4 |
| 130 | 359·2 | 359·0 | 358·7 | 358·6 | 358·4 | 358·1 | 357·6 | 310 | 0·8 | 1·0 | 1·3 | 1·4 | 1·7 | 2·0 | 2·4 |
| 140 | 359·2 | 359·1 | 358·8 | 358·6 | 358·4 | 358·1 | 357·7 | 320 | 0·8 | 0·9 | 1·2 | 1·4 | 1·6 | 1·9 | 2·4 |
| 150 | 359·3 | 359·1 | 358·9 | 358·7 | 358·5 | 358·3 | 357·9 | 330 | 0·7 | 0·9 | 1·2 | 1·3 | 1·5 | 1·8 | 2·2 |
| 160 | 359·3 | 359·2 | 359·0 | 358·9 | 358·7 | 358·5 | 358·1 | 340 | 0·7 | 0·8 | 1·0 | 1·2 | 1·3 | 1·6 | 2·0 |
| 170 | 359·4 | 359·4 | 359·1 | 359·0 | 358·9 | 358·7 | 358·4 | 350 | 0·6 | 0·7 | 0·9 | 1·0 | 1·2 | 1·4 | 1·7 |
| 180 | 359·5 | 359·5 | 359·3 | 359·2 | 359·1 | 359·0 | 358·7 | 360 | 0·5 | 0·5 | 0·7 | 0·8 | 0·9 | 1·1 | 1·4 |

When Cassiopeia is left (right), *Polaris* is west (east).

FIGURE 138.—Polaris (Pole Star) Table.



## CORRECTIONS TO BE APPLIED TO SEXTANT ALTITUDE

### REFRACTION

To be subtracted from sextant altitude (referred to as observed altitude in A.P. 3270)

| $R_0$ | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | $R_0$ | $f$ = 0·9 | 1·0 | 1·1 | 1·2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Height above sea level in units of 1 000 ft. — Sextant Altitude | | | | | | | | | | | | | $R = R_0 \times f$ — $R$ | | | |
| ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ′ | ′ | ′ | ′ | ′ |
| | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | | | | | |
| 0 | | | | | | | | | | | | | 0 | 0 | 0 | 0 | 0 |
| | 63 | 59 | 55 | 51 | 46 | 41 | 36 | 31 | 26 | 20 | 17 | 13 | | | | | |
| 1 | | | | | | | | | | | | | 1 | 1 | 1 | 1 | 1 |
| | 33 | 29 | 26 | 22 | 19 | 16 | 14 | 11 | 9 | 7 | 6 | 4 | | | | | |
| 2 | | | | | | | | | | | | | 2 | 2 | 2 | 2 | 2 |
| | 21 | 19 | 16 | 14 | 12 | 10 | 8 | 7 | 5 | 4 | 2 40 | 1 40 | | | | | |
| 3 | | | | | | | | | | | | | 3 | 3 | 3 | 3 | 4 |
| | 16 | 14 | 12 | 10 | 8 | 7 | 6 | 5 | 3 10 | 2 20 | 1 30 | 0 40 | | | | | |
| 4 | | | | | | | | | | | | | 4 | 4 | 4 | 4 | 5 |
| | 12 | 11 | 9 | 8 | 7 | 5 | 4 00 | 3 10 | 2 10 | 1 30 | 0 39 | +0 05 | | | | | |
| 5 | | | | | | | | | | | | | 5 | 5 | 5 | 5 | 6 |
| | 10 | 9 | 7 | 5 50 | 4 50 | 3 50 | 3 10 | 2 20 | 1 30 | 0 49 | +0 11 | −0 19 | | | | | |
| 6 | | | | | | | | | | | | | 6 | 5 | 6 | 7 | 7 |
| | 8 10 | 6 50 | 5 50 | 4 50 | 4 00 | 3 00 | 2 20 | 1 50 | 1 10 | 0 24 | −0 11 | −0 38 | | | | | |
| 7 | | | | | | | | | | | | | 7 | 6 | 7 | 8 | 8 |
| | 6 50 | 5 50 | 5 00 | 4 00 | 3 10 | 2 30 | 1 50 | 1 20 | 0 38 | +0 04 | −0 28 | −0 54 | | | | | |
| 8 | | | | | | | | | | | | | 8 | 7 | 8 | 9 | 10 |
| | 6 00 | 5 10 | 4 10 | 3 20 | 2 40 | 2 00 | 1 30 | 1 00 | 0 19 | −0 13 | −0 42 | −1 08 | | | | | |
| 9 | | | | | | | | | | | | | 9 | 8 | 9 | 10 | 11 |
| | 5 20 | 4 30 | 3 40 | 2 50 | 2 10 | 1 40 | 1 10 | 0 35 | +0 03 | −0 27 | −0 53 | −1 18 | | | | | |
| 10 | | | | | | | | | | | | | 10 | 9 | 10 | 11 | 12 |
| | 4 30 | 3 40 | 2 50 | 2 20 | 1 40 | 1 10 | 0 37 | +0 11 | −0 16 | −0 43 | −1 08 | −1 31 | | | | | |
| 12 | | | | | | | | | | | | | 12 | 11 | 12 | 13 | 14 |
| | 3 30 | 2 50 | 2 10 | 1 40 | 1 10 | 0 34 | +0 09 | −0 14 | −0 37 | −1 00 | −1 23 | −1 44 | | | | | |
| 14 | | | | | | | | | | | | | 14 | 13 | 14 | 15 | 17 |
| | 2 50 | 2 10 | 1 40 | 1 10 | 0 37 | +0 10 | −0 13 | −0 34 | −0 53 | −1 14 | −1 35 | −1 56 | | | | | |
| 16 | | | | | | | | | | | | | 16 | 14 | 16 | 18 | 19 |
| | 2 20 | 1 40 | 1 20 | 0 43 | +0 15 | −0 08 | −0 31 | −0 52 | −1 08 | −1 27 | −1 46 | −2 05 | | | | | |
| 18 | | | | | | | | | | | | | 18 | 16 | 18 | 20 | 22 |
| | 1 50 | 1 20 | 0 49 | +0 23 | −0 02 | −0 26 | −0 46 | −1 06 | −1 22 | −1 39 | −1 57 | −2 14 | | | | | |
| 20 | | | | | | | | | | | | | 20 | 18 | 20 | 22 | 24 |
| | 1 12 | 0 44 | +0 19 | −0 06 | −0 28 | −0 48 | −1 09 | −1 27 | −1 42 | −1 58 | −2 14 | −2 30 | | | | | |
| 25 | | | | | | | | | | | | | 25 | 22 | 25 | 28 | 30 |
| | 0 34 | +0 10 | −0 13 | −0 36 | −0 55 | −1 14 | −1 32 | −1 51 | −2 06 | −2 21 | −2 34 | −2 49 | | | | | |
| 30 | | | | | | | | | | | | | 30 | 27 | 30 | 33 | 36 |
| | +0 06 | −0 16 | −0 37 | −0 59 | −1 17 | −1 33 | −1 51 | −2 07 | −2 23 | −2 37 | −2 51 | −3 04 | | | | | |
| 35 | | | | | | | | | | | | | 35 | 31 | 35 | 38 | 42 |
| | −0 18 | −0 37 | −0 58 | −1 16 | −1 34 | −1 49 | −2 06 | −2 22 | −2 35 | −2 49 | −3 03 | −3 16 | | | | | |
| 40 | | | | | | | | | | | | | 40 | 36 | 40 | 44 | 48 |
| | | −0 53 | −1 14 | −1 31 | −1 47 | −2 03 | −2 18 | −2 33 | −2 47 | −2 59 | −3 13 | −3 25 | | | | | |
| 45 | | | | | | | | | | | | | 45 | 40 | 45 | 50 | 54 |
| | | −1 10 | −1 28 | −1 44 | −1 59 | −2 15 | −2 28 | −2 43 | −2 56 | −3 08 | −3 22 | −3 33 | | | | | |
| 50 | | | | | | | | | | | | | 50 | 45 | 50 | 55 | 60 |
| | | | −1 40 | −1 53 | −2 09 | −2 24 | −2 38 | −2 52 | −3 04 | −3 17 | −3 29 | −3 41 | | | | | |
| 55 | | | | | | | | | | | | | 55 | 49 | 55 | 60 | 66 |
| | | | | −2 03 | −2 18 | −2 33 | −2 46 | −3 01 | −3 12 | −3 25 | −3 37 | −3 48 | | | | | |
| 60 | | | | | | | | | | | | | 60 | 54 | 60 | 66 | 72 |
| | | | | | | | −2 53 | −3 07 | −3 19 | −3 31 | −3 42 | −3 53 | | | | | |

| $f$ | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | $f$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Temperature in °C. | | | | | | | | | | | | |
| | +47 | +36 | +27 | +18 | +10 | + 3 | − 5 | −13 | | | | | |
| 0·9 | | | | | | | | | | | | | 0·9 |
| | +26 | +16 | + 6 | − 4 | −13 | −22 | −31 | −40 | | | | | |
| 1·0 | | | | | | | | | | | | | 1·0 |
| | + 5 | − 5 | −15 | −25 | −36 | −46 | −57 | −68 | | | | | |
| 1·1 | | | | | | | | | | | | | 1·1 |
| | −16 | −25 | −36 | −46 | −58 | −71 | −83 | −95 | | | | | |
| 1·2 | | | | | | | | | | | | | 1·2 |
| | −37 | −45 | −56 | −67 | −81 | −95 | | | | | | | |

For these heights no temperature correction is necessary, so use $R = R_0$.

Where $R_0$ is less than 10′ or the height greater than 35 000 ft. use $R = R_0$

Choose the column appropriate to height, in units of 1 000 ft., and find the range of altitude in which the sextant altitude lies; the corresponding value of $R_0$ is the refraction, to be subtracted from sextant altitude, unless conditions are extreme. In that case find $f$ from the lower table, with critical argument temperature. Use the table on the right to form the refraction, $R = R_0 \times f$.

### CORIOLIS ($Z$) CORRECTION

To be applied by moving the position line a distance $Z$ to starboard (right) of the track in northern latitudes and to port (left) in southern latitudes.

| G/S KNOTS | Latitude 0° | 10° | 20° | 30° | 40° | 50° | 60° | 70° | 80° | 90° | G/S KNOTS | Latitude 0° | 10° | 20° | 30° | 40° | 50° | 60° | 70° | 80° | 90° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ |
| 150 | 0 | 1 | 1 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 550 | 0 | 3 | 5 | 7 | 9 | 11 | 12 | 14 | 14 | 14 |
| 200 | 0 | 1 | 2 | 3 | 3 | 4 | 5 | 5 | 5 | 5 | 600 | 0 | 3 | 5 | 8 | 10 | 12 | 14 | 15 | 16 | 16 |
| 250 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 6 | 6 | 7 | 650 | 0 | 3 | 6 | 9 | 11 | 13 | 15 | 16 | 17 | 17 |
| 300 | 0 | 1 | 3 | 4 | 5 | 6 | 7 | 7 | 8 | 8 | 700 | 0 | 3 | 6 | 9 | 12 | 14 | 16 | 17 | 18 | 18 |
| 350 | 0 | 2 | 3 | 5 | 6 | 7 | 8 | 9 | 9 | 9 | 750 | 0 | 3 | 7 | 10 | 13 | 15 | 17 | 18 | 19 | 20 |
| 400 | 0 | 2 | 4 | 5 | 7 | 8 | 9 | 10 | 10 | 10 | 800 | 0 | 4 | 7 | 10 | 13 | 16 | 18 | 20 | 21 | 21 |
| 450 | 0 | 2 | 4 | 6 | 8 | 9 | 10 | 11 | 12 | 12 | 850 | 0 | 4 | 8 | 11 | 14 | 17 | 19 | 21 | 22 | 22 |
| 500 | 0 | 2 | 4 | 7 | 8 | 10 | 11 | 12 | 13 | 13 | 900 | 0 | 4 | 8 | 12 | 15 | 18 | 20 | 22 | 23 | 24 |

FIGURE 139.—Sextant Altitude Corrections.

## LAT 32°N

| LHA ♈ | Hc | Zn | Hc | Zn | Hc | Zn | Hc | Zn | Hc | Zn | Hc | Zn | Hc | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | •VEGA | | Alphecca | | ARCTURUS | | •SPICA | | REGULUS | | •POLLUX | | Dubhe | |
| 180 | 13 09 | 052 | 43 36 | 082 | 57 15 | 105 | 42 28 | 151 | 57 20 | 239 | 35 17 | 284 | 58 44 | 347 |
| 181 | 13 50 | 053 | 44 26 | 082 | 58 04 | 105 | 42 52 | 153 | 56 36 | 240 | 34 28 | 284 | 58 32 | 346 |
| 182 | 14 30 | 053 | 45 16 | 083 | 58 53 | 106 | 43 15 | 154 | 55 52 | 241 | 33 39 | 285 | 58 19 | 345 |
| 183 | 15 11 | 053 | 46 07 | 083 | 59 42 | 107 | 43 37 | 155 | 55 07 | 242 | 32 49 | 285 | 58 06 | 345 |
| 184 | 15 52 | 054 | 46 58 | 084 | 60 30 | 108 | 43 58 | 156 | 54 22 | 243 | 32 00 | 285 | 57 52 | 344 |
| 185 | 16 33 | 054 | 47 48 | 084 | 61 19 | 109 | 44 17 | 158 | 53 36 | 244 | 31 11 | 286 | 57 38 | 343 |
| 186 | 17 15 | 055 | 48 39 | 085 | 62 06 | 110 | 44 36 | 159 | 52 50 | 245 | 30 22 | 286 | 57 23 | 342 |
| 187 | 17 56 | 055 | 49 29 | 085 | 62 54 | 111 | 44 54 | 160 | 52 04 | 246 | 29 33 | 286 | 57 07 | 342 |
| 188 | 18 38 | 055 | 50 20 | 085 | 63 41 | 113 | 45 10 | 162 | 51 17 | 247 | 28 45 | 287 | 56 50 | 341 |
| 189 | 19 20 | 056 | 51 11 | 086 | 64 28 | 114 | 45 26 | 163 | 50 30 | 248 | 27 56 | 287 | 56 33 | 340 |
| 190 | 20 02 | 056 | 52 02 | 086 | 65 14 | 115 | 45 40 | 164 | 49 42 | 249 | 27 08 | 288 | 56 16 | 339 |
| 191 | 20 44 | 056 | 52 52 | 087 | 66 00 | 116 | 45 53 | 166 | 48 55 | 250 | 26 19 | 288 | 55 58 | 339 |
| 192 | 21 27 | 057 | 53 43 | 087 | 66 45 | 118 | 46 05 | 167 | 48 07 | 251 | 25 31 | 288 | 55 39 | 338 |
| 193 | 22 10 | 057 | 54 34 | 088 | 67 30 | 119 | 46 16 | 169 | 47 18 | 252 | 24 43 | 289 | 55 20 | 338 |
| 194 | 22 52 | 057 | 55 25 | 088 | 68 14 | 121 | 46 25 | 170 | 46 30 | 253 | 23 54 | 289 | 55 00 | 337 |
| | •Kochab | | VEGA | | Rasalhague | | •ANTARES | | SPICA | | •REGULUS | | Dubhe | |
| 195 | 45 34 | 010 | 23 35 | 058 | 24 45 | 090 | 13 24 | 133 | 46 33 | 171 | 45 41 | 253 | 54 40 | 336 |
| 196 | 45 43 | 010 | 24 18 | 058 | 25 36 | 091 | 14 01 | 134 | 46 40 | 173 | 44 53 | 254 | 54 20 | 336 |
| 197 | 45 51 | 010 | 25 02 | 058 | 26 27 | 091 | 14 37 | 135 | 46 46 | 174 | 44 04 | 255 | 53 59 | 335 |
| 198 | 46 00 | 009 | 25 45 | 059 | 27 18 | 092 | 15 13 | 135 | 46 51 | 176 | 43 14 | 256 | 53 37 | 335 |
| 199 | 46 08 | 009 | 26 29 | 059 | 28 09 | 092 | 15 48 | 136 | 46 54 | 177 | 42 25 | 256 | 53 15 | 334 |
| 200 | 46 16 | 009 | 27 13 | 059 | 28 59 | 093 | 16 23 | 137 | 46 56 | 179 | 41 36 | 257 | 52 53 | 334 |
| 201 | 46 23 | 008 | 27 56 | 060 | 29 50 | 094 | 16 58 | 138 | 46 57 | 180 | 40 46 | 258 | 52 30 | 333 |
| 202 | 46 31 | 008 | 28 40 | 060 | 30 41 | 094 | 17 32 | 138 | 46 56 | 181 | 39 56 | 258 | 52 07 | 333 |
| 203 | 46 38 | 008 | 29 25 | 060 | 31 32 | 095 | 18 05 | 139 | 46 54 | 183 | 39 06 | 259 | 51 44 | 332 |
| 204 | 46 44 | 007 | 30 09 | 061 | 32 22 | 095 | 18 39 | 140 | 46 51 | 184 | 38 16 | 260 | 51 20 | 332 |
| 205 | 46 51 | 007 | 30 53 | 061 | 33 13 | 096 | 19 11 | 141 | 46 47 | 186 | 37 26 | 260 | 50 56 | 332 |
| 206 | 46 57 | 007 | 31 38 | 061 | 34 04 | 096 | 19 43 | 141 | 46 41 | 187 | 36 36 | 261 | 50 32 | 331 |
| 207 | 47 02 | 006 | 32 22 | 061 | 34 54 | 097 | 20 15 | 142 | 46 34 | 189 | 35 46 | 262 | 50 07 | 331 |
| 208 | 47 08 | 006 | 33 07 | 062 | 35 45 | 098 | 20 46 | 143 | 46 26 | 190 | 34 55 | 262 | 49 43 | 331 |
| 209 | 47 12 | 005 | 33 52 | 062 | 36 35 | 098 | 21 16 | 144 | 46 16 | 191 | 34 05 | 263 | 49 17 | 330 |
| | •Kochab | | VEGA | | Rasalhague | | •ANTARES | | SPICA | | •REGULUS | | Dubhe | |
| 210 | 47 17 | 005 | 34 37 | 062 | 37 25 | 099 | 21 46 | 144 | 46 06 | 193 | 33 14 | 263 | 48 52 | 330 |
| 211 | 47 21 | 005 | 35 22 | 062 | 38 16 | 100 | 22 15 | 145 | 45 54 | 194 | 32 24 | 264 | 48 26 | 330 |
| 212 | 47 25 | 004 | 36 07 | 063 | 39 06 | 100 | 22 44 | 146 | 45 41 | 195 | 31 33 | 265 | 48 00 | 329 |
| 213 | 47 29 | 004 | 36 52 | 063 | 39 56 | 101 | 23 12 | 147 | 45 27 | 197 | 30 42 | 265 | 47 34 | 329 |
| 214 | 47 32 | 003 | 37 38 | 063 | 40 46 | 102 | 23 39 | 148 | 45 11 | 198 | 29 52 | 266 | 47 08 | 329 |
| 215 | 47 35 | 003 | 38 23 | 063 | 41 35 | 102 | 24 06 | 149 | 44 55 | 200 | 29 01 | 266 | 46 42 | 329 |
| 216 | 47 38 | 003 | 39 09 | 064 | 42 25 | 103 | 24 32 | 149 | 44 37 | 201 | 28 10 | 267 | 46 15 | 328 |
| 217 | 47 40 | 002 | 39 55 | 064 | 43 15 | 104 | 24 58 | 150 | 44 19 | 202 | 27 19 | 267 | 45 48 | 328 |
| 218 | 47 42 | 002 | 40 40 | 064 | 44 04 | 104 | 25 23 | 151 | 43 59 | 203 | 26 28 | 268 | 45 21 | 328 |
| 219 | 47 43 | 001 | 41 26 | 064 | 44 53 | 105 | 25 47 | 152 | 43 38 | 205 | 25 38 | 268 | 44 54 | 328 |
| 220 | 47 44 | 001 | 42 12 | 065 | 45 42 | 106 | 26 10 | 153 | 43 16 | 206 | 24 47 | 269 | 44 27 | 328 |
| 221 | 47 45 | 001 | 42 58 | 065 | 46 31 | 107 | 26 33 | 154 | 42 54 | 207 | 23 56 | 270 | 43 59 | 327 |
| 222 | 47 46 | 000 | 43 44 | 065 | 47 20 | 107 | 26 55 | 155 | 42 30 | 208 | 23 05 | 270 | 43 32 | 327 |
| 223 | 47 46 | 000 | 44 30 | 065 | 48 08 | 108 | 27 16 | 156 | 42 05 | 210 | 22 14 | 271 | 43 04 | 327 |
| 224 | 47 45 | 359 | 45 16 | 065 | 48 56 | 109 | 27 37 | 157 | 41 40 | 211 | 21 23 | 271 | 42 37 | 327 |
| | DENEB | | VEGA | | •ALTAIR | | ANTARES | | •SPICA | | Denebola | | •Dubhe | |
| 225 | 25 14 | 051 | 46 03 | 065 | 19 30 | 092 | 27 57 | 158 | 41 13 | 212 | 43 06 | 260 | 42 09 | 327 |
| 226 | 25 53 | 051 | 46 49 | 066 | 20 21 | 092 | 28 16 | 159 | 40 46 | 213 | 42 16 | 261 | 41 41 | 327 |
| 227 | 26 33 | 051 | 47 35 | 066 | 21 12 | 093 | 28 34 | 160 | 40 17 | 214 | 41 26 | 261 | 41 13 | 327 |
| 228 | 27 13 | 052 | 48 22 | 066 | 22 03 | 093 | 28 51 | 161 | 39 48 | 215 | 40 36 | 262 | 40 45 | 327 |
| 229 | 27 53 | 052 | 49 08 | 066 | 22 54 | 094 | 29 08 | 161 | 39 18 | 216 | 39 45 | 262 | 40 17 | 326 |
| 230 | 28 33 | 052 | 49 55 | 066 | 23 44 | 094 | 29 24 | 162 | 38 48 | 218 | 38 55 | 263 | 39 49 | 326 |
| 231 | 29 13 | 052 | 50 41 | 066 | 24 35 | 095 | 29 38 | 163 | 38 16 | 219 | 38 04 | 264 | 39 21 | 326 |
| 232 | 29 54 | 053 | 51 28 | 066 | 25 26 | 096 | 29 53 | 164 | 37 44 | 220 | 37 14 | 264 | 38 52 | 326 |
| 233 | 30 34 | 053 | 52 14 | 066 | 26 16 | 096 | 30 06 | 165 | 37 11 | 221 | 36 23 | 265 | 38 24 | 326 |
| 234 | 31 15 | 053 | 53 01 | 067 | 27 07 | 097 | 30 18 | 166 | 36 38 | 222 | 35 32 | 265 | 37 56 | 326 |
| 235 | 31 56 | 053 | 53 48 | 067 | 27 57 | 097 | 30 30 | 167 | 36 04 | 223 | 34 42 | 266 | 37 27 | 326 |
| 236 | 32 36 | 054 | 54 35 | 067 | 28 48 | 098 | 30 40 | 168 | 35 29 | 224 | 33 51 | 267 | 36 59 | 326 |
| 237 | 33 17 | 054 | 55 21 | 067 | 29 38 | 098 | 30 50 | 170 | 34 53 | 225 | 33 00 | 267 | 36 31 | 326 |
| 238 | 33 59 | 054 | 56 08 | 067 | 30 28 | 099 | 30 59 | 171 | 34 17 | 226 | 32 09 | 268 | 36 03 | 326 |
| 239 | 34 40 | 054 | 56 55 | 067 | 31 19 | 100 | 31 07 | 172 | 33 41 | 227 | 31 18 | 268 | 35 34 | 326 |
| | •DENEB | | ALTAIR | | Nunki | | •ANTARES | | SPICA | | ARCTURUS | | •Alkaid | |
| 240 | 35 21 | 054 | 32 09 | 100 | 18 26 | 139 | 31 14 | 173 | 33 04 | 227 | 63 12 | 248 | 59 43 | 315 |
| 241 | 36 02 | 055 | 32 59 | 101 | 18 59 | 140 | 31 20 | 174 | 32 26 | 228 | 62 24 | 249 | 59 07 | 314 |
| 242 | 36 44 | 055 | 33 49 | 102 | 19 32 | 141 | 31 25 | 175 | 31 48 | 229 | 61 37 | 250 | 58 30 | 314 |
| 243 | 37 26 | 055 | 34 38 | 102 | 20 03 | 142 | 31 29 | 176 | 31 09 | 230 | 60 48 | 251 | 57 53 | 314 |
| 244 | 38 07 | 055 | 35 28 | 103 | 20 35 | 142 | 31 32 | 177 | 30 30 | 231 | 60 00 | 252 | 57 16 | 313 |
| 245 | 38 49 | 055 | 36 18 | 104 | 21 05 | 143 | 31 35 | 178 | 29 50 | 232 | 59 12 | 253 | 56 39 | 313 |
| 246 | 39 31 | 055 | 37 07 | 104 | 21 36 | 144 | 31 36 | 179 | 29 10 | 233 | 58 23 | 254 | 56 02 | 312 |
| 247 | 40 13 | 055 | 37 56 | 105 | 22 05 | 145 | 31 37 | 180 | 28 29 | 233 | 57 34 | 255 | 55 24 | 312 |
| 248 | 40 54 | 056 | 38 45 | 106 | 22 34 | 146 | 31 36 | 181 | 27 48 | 234 | 56 44 | 256 | 54 46 | 312 |
| 249 | 41 36 | 056 | 39 34 | 106 | 23 03 | 147 | 31 35 | 182 | 27 06 | 235 | 55 55 | 257 | 54 08 | 312 |
| 250 | 42 18 | 056 | 40 23 | 107 | 23 30 | 147 | 31 33 | 183 | 26 25 | 236 | 55 05 | 258 | 53 30 | 311 |
| 251 | 43 01 | 056 | 41 12 | 108 | 23 57 | 148 | 31 29 | 184 | 25 42 | 237 | 54 15 | 258 | 52 52 | 311 |
| 252 | 43 43 | 056 | 42 00 | 109 | 24 24 | 149 | 31 25 | 185 | 25 00 | 237 | 53 26 | 259 | 52 14 | 311 |
| 253 | 44 25 | 056 | 42 48 | 109 | 24 50 | 150 | 31 20 | 186 | 24 17 | 238 | 52 36 | 260 | 51 35 | 311 |
| 254 | 45 07 | 056 | 43 36 | 110 | 25 15 | 151 | 31 14 | 187 | 23 33 | 239 | 51 45 | 261 | 50 57 | 311 |
| | •DENEB | | ALTAIR | | Nunki | | •ANTARES | | ARCTURUS | | •Alkaid | | Kochab | |
| 255 | 45 49 | 056 | 44 23 | 111 | 25 39 | 152 | 31 07 | 188 | 50 55 | 261 | 50 18 | 310 | 44 48 | 348 |
| 256 | 46 32 | 056 | 45 11 | 112 | 26 03 | 153 | 30 59 | 189 | 50 05 | 262 | 49 39 | 310 | 44 38 | 348 |
| 257 | 47 14 | 056 | 45 58 | 113 | 26 26 | 153 | 30 51 | 190 | 49 14 | 263 | 49 00 | 310 | 44 27 | 348 |
| 258 | 47 56 | 056 | 46 45 | 114 | 26 49 | 154 | 30 41 | 191 | 48 24 | 263 | 48 21 | 310 | 44 16 | 347 |
| 259 | 48 38 | 056 | 47 31 | 115 | 27 10 | 155 | 30 31 | 192 | 47 33 | 264 | 47 43 | 310 | 44 05 | 347 |
| 260 | 49 21 | 056 | 48 17 | 115 | 27 31 | 156 | 30 19 | 193 | 46 43 | 265 | 47 04 | 310 | 43 53 | 347 |
| 261 | 50 03 | 056 | 49 03 | 116 | 27 51 | 157 | 30 07 | 194 | 45 52 | 265 | 46 25 | 310 | 43 41 | 347 |
| 262 | 50 45 | 056 | 49 48 | 117 | 28 11 | 158 | 29 54 | 195 | 45 01 | 266 | 45 46 | 310 | 43 29 | 346 |
| 263 | 51 27 | 056 | 50 33 | 118 | 28 29 | 159 | 29 40 | 196 | 44 11 | 266 | 45 07 | 310 | 43 17 | 346 |
| 264 | 52 09 | 056 | 51 18 | 119 | 28 47 | 160 | 29 25 | 197 | 43 20 | 267 | 44 28 | 310 | 43 05 | 346 |
| 265 | 52 52 | 056 | 52 02 | 120 | 29 04 | 161 | 29 09 | 198 | 42 29 | 267 | 43 49 | 310 | 42 52 | 346 |
| 266 | 53 34 | 056 | 52 46 | 122 | 29 20 | 162 | 28 53 | 199 | 41 38 | 268 | 43 10 | 310 | 42 39 | 345 |
| 267 | 54 16 | 056 | 53 29 | 123 | 29 35 | 163 | 28 35 | 200 | 40 47 | 269 | 42 30 | 310 | 42 26 | 345 |
| 268 | 54 58 | 055 | 54 11 | 124 | 29 50 | 164 | 28 17 | 201 | 39 56 | 269 | 41 51 | 310 | 42 13 | 345 |
| 269 | 55 40 | 055 | 54 53 | 125 | 30 04 | 165 | 27 58 | 202 | 39 05 | 270 | 41 13 | 310 | 42 00 | 345 |

## LAT 32°N

| LHA ♈ | Hc | Zn | Hc | Zn | Hc | Zn | Hc | Zn | Hc | Zn | Hc | Zn | Hc | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | •DENEB | | ALTAIR | | •Nunki | | ANTARES | | ARCTURUS | | •Alkaid | | Kochab | |
| 270 | 56 21 | 055 | 55 35 | 126 | 30 16 | 166 | 27 39 | 203 | 38 15 | 270 | 40 34 | 310 | 41 46 | 344 |
| 271 | 57 03 | 055 | 56 15 | 128 | 30 28 | 167 | 27 18 | 204 | 37 24 | 271 | 39 55 | 310 | 41 33 | 344 |
| 272 | 57 45 | 055 | 56 55 | 129 | 30 39 | 168 | 26 57 | 205 | 36 33 | 271 | 39 16 | 310 | 41 19 | 344 |
| 273 | 58 26 | 054 | 57 34 | 130 | 30 49 | 169 | 26 35 | 206 | 35 42 | 272 | 38 37 | 310 | 41 05 | 344 |
| 274 | 59 07 | 054 | 58 13 | 132 | 30 59 | 170 | 26 12 | 207 | 34 51 | 272 | 37 58 | 310 | 40 51 | 344 |
| 275 | 59 49 | 054 | 58 50 | 133 | 31 07 | 171 | 25 49 | 208 | 34 00 | 273 | 37 19 | 311 | 40 36 | 344 |
| 276 | 60 30 | 053 | 59 27 | 135 | 31 14 | 172 | 25 25 | 209 | 33 09 | 273 | 36 41 | 311 | 40 22 | 343 |
| 277 | 61 10 | 053 | 60 03 | 136 | 31 21 | 173 | 25 00 | 210 | 32 19 | 274 | 36 02 | 311 | 40 07 | 343 |
| 278 | 61 51 | 053 | 60 37 | 138 | 31 26 | 174 | 24 35 | 210 | 31 28 | 274 | 35 24 | 311 | 39 52 | 343 |
| 279 | 62 31 | 052 | 61 11 | 140 | 31 31 | 175 | 24 09 | 211 | 30 37 | 275 | 34 45 | 311 | 39 38 | 343 |
| 280 | 63 12 | 052 | 61 43 | 141 | 31 35 | 176 | 23 42 | 212 | 29 47 | 275 | 34 07 | 311 | 39 23 | 343 |
| 281 | 63 51 | 051 | 62 15 | 143 | 31 38 | 177 | 23 14 | 213 | 28 56 | 276 | 33 29 | 311 | 39 07 | 343 |
| 282 | 64 31 | 051 | 62 44 | 145 | 31 40 | 178 | 22 46 | 214 | 28 05 | 276 | 32 51 | 311 | 38 52 | 343 |
| 283 | 65 10 | 050 | 63 13 | 147 | 31 41 | 179 | 22 18 | 215 | 27 15 | 277 | 32 12 | 312 | 38 37 | 342 |
| 284 | 65 49 | 049 | 63 40 | 149 | 31 41 | 181 | 21 49 | 215 | 26 24 | 277 | 31 35 | 312 | 38 22 | 342 |
| | •Alpheratz | | Enif | | ALTAIR | | •ANTARES | | ARCTURUS | | •Alkaid | | Kochab | |
| 285 | 25 12 | 070 | 46 17 | 111 | 64 06 | 151 | 21 19 | 216 | 25 34 | 278 | 30 57 | 312 | 38 06 | 342 |
| 286 | 26 00 | 071 | 47 04 | 112 | 64 30 | 153 | 20 48 | 217 | 24 43 | 278 | 30 19 | 312 | 37 50 | 342 |
| 287 | 26 48 | 071 | 47 51 | 113 | 64 52 | 155 | 20 18 | 218 | 23 53 | 279 | 29 41 | 312 | 37 35 | 342 |
| 288 | 27 36 | 071 | 48 37 | 114 | 65 13 | 157 | 19 46 | 219 | 23 03 | 279 | 29 04 | 313 | 37 19 | 342 |
| 289 | 28 24 | 072 | 49 24 | 115 | 65 31 | 159 | 19 14 | 219 | 22 12 | 280 | 28 26 | 313 | 37 03 | 342 |
| 290 | 29 13 | 072 | 50 10 | 116 | 65 48 | 162 | 18 41 | 220 | 21 22 | 280 | 27 49 | 313 | 36 47 | 342 |
| 291 | 30 01 | 073 | 50 55 | 117 | 66 03 | 164 | 18 08 | 221 | 20 32 | 280 | 27 12 | 313 | 36 31 | 342 |
| 292 | 30 50 | 073 | 51 40 | 118 | 66 16 | 167 | 17 35 | 222 | 19 42 | 281 | 26 35 | 314 | 36 15 | 342 |
| 293 | 31 38 | 073 | 52 25 | 119 | 66 27 | 169 | 17 01 | 222 | 18 52 | 281 | 25 58 | 314 | 35 59 | 342 |
| 294 | 32 27 | 074 | 53 10 | 120 | 66 36 | 171 | 16 26 | 223 | 18 03 | 282 | 25 22 | 314 | 35 43 | 342 |
| 295 | 33 16 | 074 | 53 53 | 121 | 66 42 | 174 | 15 51 | 224 | 17 13 | 282 | 24 45 | 314 | 35 27 | 341 |
| 296 | 34 05 | 075 | 54 37 | 122 | 66 47 | 176 | 15 16 | 224 | 16 23 | 283 | 24 09 | 315 | 35 11 | 341 |
| 297 | 34 54 | 075 | 55 19 | 123 | 66 49 | 179 | 14 40 | 225 | 15 34 | 283 | 23 33 | 315 | 34 55 | 341 |
| 298 | 35 43 | 075 | 56 02 | 125 | 66 49 | 181 | 14 04 | 226 | 14 44 | 284 | 22 57 | 315 | 34 38 | 341 |
| 299 | 36 33 | 076 | 56 43 | 126 | 66 46 | 184 | 13 27 | 227 | 13 55 | 284 | 22 21 | 315 | 34 22 | 341 |
| | •Mirfak | | Alpheratz | | •FOMALHAUT | | ALTAIR | | Rasalhague | | •Alphecca | | Kochab | |
| 300 | 12 11 | 038 | 37 22 | 076 | 15 25 | 141 | 66 42 | 186 | 51 20 | 248 | 32 42 | 283 | 34 06 | 341 |
| 301 | 12 42 | 039 | 38 11 | 076 | 15 56 | 142 | 66 35 | 189 | 50 32 | 249 | 31 52 | 284 | 33 49 | 341 |
| 302 | 13 14 | 039 | 39 01 | 077 | 16 27 | 143 | 66 26 | 191 | 49 45 | 250 | 31 03 | 284 | 33 33 | 341 |
| 303 | 13 46 | 039 | 39 50 | 077 | 16 58 | 143 | 66 15 | 194 | 48 57 | 251 | 30 14 | 285 | 33 17 | 341 |
| 304 | 14 19 | 040 | 40 40 | 078 | 17 28 | 144 | 66 02 | 196 | 48 08 | 252 | 29 24 | 285 | 33 01 | 341 |
| 305 | 14 51 | 040 | 41 30 | 078 | 17 58 | 145 | 65 47 | 198 | 47 20 | 253 | 28 35 | 285 | 32 44 | 341 |
| 306 | 15 24 | 040 | 42 20 | 078 | 18 27 | 146 | 65 30 | 201 | 46 31 | 253 | 27 46 | 286 | 32 28 | 341 |
| 307 | 15 57 | 041 | 43 09 | 079 | 18 55 | 146 | 65 11 | 203 | 45 42 | 254 | 26 57 | 286 | 32 12 | 341 |
| 308 | 16 30 | 041 | 43 59 | 079 | 19 23 | 147 | 64 50 | 205 | 44 53 | 255 | 26 08 | 287 | 31 56 | 341 |
| 309 | 17 04 | 041 | 44 49 | 079 | 19 51 | 148 | 64 27 | 207 | 44 04 | 256 | 25 20 | 287 | 31 39 | 341 |
| 310 | 17 38 | 042 | 45 39 | 080 | 20 17 | 149 | 64 03 | 209 | 43 15 | 256 | 24 31 | 287 | 31 23 | 341 |
| 311 | 18 12 | 042 | 46 29 | 080 | 20 43 | 150 | 63 38 | 211 | 42 25 | 257 | 23 43 | 288 | 31 07 | 342 |
| 312 | 18 46 | 042 | 47 20 | 080 | 21 09 | 150 | 63 10 | 213 | 41 36 | 258 | 22 54 | 288 | 30 51 | 342 |
| 313 | 19 20 | 043 | 48 10 | 081 | 21 34 | 151 | 62 42 | 215 | 40 46 | 258 | 22 06 | 289 | 30 35 | 342 |
| 314 | 19 55 | 043 | 49 00 | 081 | 21 58 | 152 | 62 12 | 217 | 39 56 | 259 | 21 18 | 289 | 30 19 | 342 |
| | •Mirfak | | Hamal | | Diphda | | •FOMALHAUT | | ALTAIR | | •VEGA | | Kochab | |
| 315 | 20 30 | 043 | 23 04 | 076 | 16 52 | 125 | 22 22 | 153 | 61 40 | 219 | 60 08 | 293 | 30 03 | 342 |
| 316 | 21 05 | 044 | 23 53 | 076 | 17 34 | 126 | 22 45 | 154 | 61 08 | 221 | 59 21 | 293 | 29 47 | 342 |
| 317 | 21 40 | 044 | 24 43 | 077 | 18 15 | 126 | 23 07 | 154 | 60 34 | 222 | 58 34 | 293 | 29 31 | 342 |
| 318 | 22 15 | 044 | 25 32 | 077 | 18 56 | 127 | 23 28 | 155 | 59 59 | 224 | 57 48 | 293 | 29 15 | 342 |
| 319 | 22 51 | 044 | 26 22 | 078 | 19 37 | 128 | 23 49 | 156 | 59 23 | 225 | 57 01 | 293 | 28 59 | 342 |
| 320 | 23 26 | 045 | 27 12 | 078 | 20 17 | 128 | 24 10 | 157 | 58 47 | 227 | 56 14 | 293 | 28 44 | 342 |
| 321 | 24 02 | 045 | 28 02 | 079 | 20 56 | 129 | 24 29 | 158 | 58 09 | 228 | 55 27 | 293 | 28 28 | 342 |
| 322 | 24 38 | 045 | 28 52 | 079 | 21 36 | 130 | 24 48 | 159 | 57 31 | 230 | 54 41 | 293 | 28 13 | 342 |
| 323 | 25 15 | 045 | 29 42 | 080 | 22 14 | 131 | 25 06 | 160 | 56 51 | 231 | 53 54 | 293 | 27 57 | 342 |
| 324 | 25 51 | 046 | 30 32 | 080 | 22 53 | 131 | 25 23 | 161 | 56 11 | 233 | 53 07 | 293 | 27 42 | 342 |
| 325 | 26 27 | 046 | 31 22 | 080 | 23 31 | 132 | 25 39 | 162 | 55 31 | 234 | 52 21 | 293 | 27 27 | 343 |
| 326 | 27 04 | 046 | 32 12 | 081 | 24 08 | 133 | 25 55 | 163 | 54 49 | 235 | 51 34 | 294 | 27 11 | 343 |
| 327 | 27 41 | 046 | 33 02 | 081 | 24 45 | 134 | 26 10 | 163 | 54 07 | 236 | 50 47 | 294 | 26 56 | 343 |
| 328 | 28 18 | 047 | 33 53 | 082 | 25 22 | 135 | 26 24 | 164 | 53 25 | 237 | 50 01 | 294 | 26 41 | 343 |
| 329 | 28 55 | 047 | 34 43 | 082 | 25 58 | 135 | 26 37 | 165 | 52 41 | 239 | 49 14 | 294 | 26 26 | 343 |
| | •Mirfak | | Hamal | | Diphda | | •FOMALHAUT | | ALTAIR | | •VEGA | | Kochab | |
| 330 | 29 32 | 047 | 35 33 | 083 | 26 33 | 136 | 26 50 | 166 | 51 58 | 240 | 48 28 | 294 | 26 12 | 343 |
| 331 | 30 09 | 047 | 36 24 | 083 | 27 08 | 137 | 27 01 | 167 | 51 14 | 241 | 47 41 | 294 | 25 57 | 343 |
| 332 | 30 47 | 047 | 37 14 | 084 | 27 43 | 138 | 27 12 | 168 | 50 29 | 242 | 46 55 | 294 | 25 43 | 343 |
| 333 | 31 24 | 048 | 38 05 | 084 | 28 16 | 139 | 27 22 | 169 | 49 44 | 243 | 46 09 | 295 | 25 28 | 344 |
| 334 | 32 02 | 048 | 38 56 | 084 | 28 50 | 140 | 27 32 | 170 | 48 59 | 244 | 45 22 | 295 | 25 14 | 344 |
| 335 | 32 40 | 048 | 39 46 | 085 | 29 22 | 141 | 27 40 | 171 | 48 13 | 245 | 44 36 | 295 | 25 00 | 344 |
| 336 | 33 18 | 048 | 40 37 | 085 | 29 54 | 141 | 27 47 | 172 | 47 27 | 246 | 43 50 | 295 | 24 46 | 344 |
| 337 | 33 56 | 048 | 41 28 | 086 | 30 26 | 142 | 27 54 | 173 | 46 40 | 246 | 43 04 | 295 | 24 32 | 344 |
| 338 | 34 34 | 048 | 42 19 | 086 | 30 56 | 143 | 28 00 | 174 | 45 53 | 247 | 42 18 | 295 | 24 18 | 344 |
| 339 | 35 12 | 049 | 43 09 | 087 | 31 27 | 144 | 28 05 | 175 | 45 06 | 248 | 41 32 | 296 | 24 04 | 345 |
| 340 | 35 50 | 049 | 44 00 | 087 | 31 56 | 145 | 28 09 | 176 | 44 19 | 249 | 40 46 | 296 | 23 51 | 345 |
| 341 | 36 28 | 049 | 44 51 | 088 | 32 25 | 146 | 28 12 | 177 | 43 31 | 250 | 40 00 | 296 | 23 37 | 345 |
| 342 | 37 07 | 049 | 45 42 | 088 | 32 53 | 147 | 28 14 | 178 | 42 43 | 251 | 39 15 | 296 | 23 24 | 345 |
| 343 | 37 45 | 049 | 46 33 | 089 | 33 20 | 148 | 28 16 | 179 | 41 55 | 251 | 38 29 | 297 | 23 11 | 345 |
| 344 | 38 24 | 049 | 47 24 | 089 | 33 46 | 149 | 28 16 | 180 | 41 07 | 252 | 37 44 | 297 | 22 58 | 345 |
| | •CAPELLA | | ALDEBARAN | | Diphda | | •FOMALHAUT | | ALTAIR | | •VEGA | | Kochab | |
| 345 | 20 00 | 048 | 13 52 | 079 | 34 12 | 150 | 28 16 | 181 | 40 18 | 253 | 36 58 | 297 | 22 46 | 346 |
| 346 | 20 37 | 048 | 14 42 | 080 | 34 37 | 151 | 28 15 | 182 | 39 30 | 254 | 36 13 | 297 | 22 33 | 346 |
| 347 | 21 15 | 048 | 15 32 | 080 | 35 01 | 152 | 28 13 | 183 | 38 41 | 254 | 35 28 | 297 | 22 20 | 346 |
| 348 | 21 53 | 048 | 16 22 | 081 | 35 24 | 153 | 28 10 | 184 | 37 52 | 255 | 34 43 | 298 | 22 08 | 346 |
| 349 | 22 32 | 049 | 17 12 | 081 | 35 47 | 154 | 28 06 | 185 | 37 02 | 256 | 33 58 | 298 | 21 56 | 346 |
| 350 | 23 10 | 049 | 18 02 | 081 | 36 08 | 155 | 28 01 | 186 | 36 13 | 256 | 33 13 | 298 | 21 44 | 347 |
| 351 | 23 48 | 049 | 18 53 | 082 | 36 29 | 157 | 27 56 | 187 | 35 23 | 257 | 32 28 | 299 | 21 32 | 347 |
| 352 | 24 27 | 050 | 19 43 | 082 | 36 49 | 158 | 27 49 | 188 | 34 34 | 258 | 31 43 | 299 | 21 21 | 347 |
| 353 | 25 06 | 050 | 20 34 | 083 | 37 08 | 159 | 27 42 | 189 | 33 44 | 258 | 30 59 | 299 | 21 10 | 347 |
| 354 | 25 45 | 050 | 21 24 | 083 | 37 25 | 160 | 27 34 | 190 | 32 54 | 259 | 30 15 | 299 | 20 58 | 347 |
| 355 | 26 24 | 050 | 22 15 | 084 | 37 42 | 161 | 27 25 | 191 | 32 04 | 260 | 29 30 | 300 | 20 47 | 348 |
| 356 | 27 04 | 051 | 23 05 | 084 | 37 58 | 162 | 27 15 | 192 | 31 14 | 260 | 28 46 | 300 | 20 36 | 348 |
| 357 | 27 43 | 051 | 23 56 | 085 | 38 13 | 163 | 27 05 | 193 | 30 24 | 261 | 28 02 | 300 | 20 26 | 348 |
| 358 | 28 23 | 051 | 24 47 | 085 | 38 27 | 165 | 26 53 | 193 | 29 33 | 262 | 27 18 | 301 | 20 15 | 348 |
| 359 | 29 02 | 051 | 25 38 | 086 | 38 41 | 166 | 26 41 | 194 | 28 43 | 262 | 26 34 | 301 | 20 05 | 348 |

FIGURE 140.—LAT 32°N.

## LAT 26°N

| LHA ♈ | Hc | Zn | Hc | Zn | Hc | Zn | Hc | Zn | Hc | Zn | Hc | Zn | Hc | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Schedar | | •CAPELLA | | ALDEBARAN | | •Diphda | | FOMALHAUT | | ALTAIR | | •DENEB | |
| 0 | 58 45 | 010 | 25 53 | 049 | 25 57 | 083 | 44 42 | 166 | 32 14 | 196 | 28 28 | 266 | 46 02 | 309 |
| 1 | 58 55 | 009 | 26 34 | 049 | 26 50 | 084 | 44 55 | 167 | 31 59 | 197 | 27 34 | 266 | 45 20 | 309 |
| 2 | 59 03 | 008 | 27 15 | 050 | 27 44 | 084 | 45 07 | 168 | 31 42 | 198 | 26 40 | 267 | 44 38 | 309 |
| 3 | 59 10 | 007 | 27 56 | 050 | 28 38 | 085 | 45 17 | 170 | 31 25 | 199 | 25 46 | 267 | 43 56 | 309 |
| 4 | 59 17 | 006 | 28 37 | 050 | 29 31 | 085 | 45 26 | 171 | 31 07 | 200 | 24 53 | 268 | 43 14 | 309 |
| 5 | 59 22 | 005 | 29 18 | 050 | 30 25 | 085 | 45 34 | 172 | 30 48 | 201 | 23 59 | 268 | 42 32 | 309 |
| 6 | 59 27 | 004 | 30 00 | 050 | 31 19 | 086 | 45 40 | 174 | 30 28 | 202 | 23 05 | 269 | 41 50 | 309 |
| 7 | 59 30 | 003 | 30 41 | 050 | 32 13 | 086 | 45 46 | 175 | 30 07 | 203 | 22 11 | 269 | 41 08 | 308 |
| 8 | 59 33 | 002 | 31 22 | 050 | 33 06 | 087 | 45 50 | 176 | 29 46 | 204 | 21 17 | 270 | 40 25 | 308 |
| 9 | 59 34 | 001 | 32 04 | 050 | 34 00 | 087 | 45 52 | 178 | 29 23 | 205 | 20 23 | 270 | 39 43 | 308 |
| 10 | 59 34 | 000 | 32 45 | 050 | 34 54 | 087 | 45 54 | 179 | 29 01 | 206 | 19 29 | 270 | 39 01 | 308 |
| 11 | 59 34 | 359 | 33 27 | 050 | 35 48 | 088 | 45 54 | 180 | 28 37 | 207 | 18 35 | 271 | 38 19 | 308 |
| 12 | 59 32 | 358 | 34 09 | 051 | 36 42 | 088 | 45 53 | 182 | 28 13 | 207 | 17 41 | 271 | 37 36 | 308 |
| 13 | 59 29 | 357 | 34 50 | 051 | 37 36 | 089 | 45 51 | 183 | 27 47 | 208 | 16 47 | 272 | 36 54 | 308 |
| 14 | 59 25 | 355 | 35 32 | 051 | 38 30 | 089 | 45 47 | 185 | 27 21 | 209 | 15 53 | 272 | 36 12 | 308 |
| | •CAPELLA | | ALDEBARAN | | RIGEL | | •Diphda | | FOMALHAUT | | Enif | | •DENEB | |
| 15 | 36 14 | 051 | 39 24 | 090 | 19 37 | 110 | 45 42 | 186 | 26 55 | 210 | 40 47 | 260 | 35 30 | 308 |
| 16 | 36 55 | 051 | 40 18 | 090 | 20 27 | 111 | 45 36 | 187 | 26 27 | 211 | 39 54 | 261 | 34 47 | 309 |
| 17 | 37 37 | 051 | 41 11 | 090 | 21 18 | 111 | 45 28 | 189 | 25 59 | 212 | 39 01 | 261 | 34 05 | 309 |
| 18 | 38 19 | 051 | 42 05 | 091 | 22 08 | 112 | 45 20 | 190 | 25 31 | 212 | 38 07 | 262 | 33 23 | 309 |
| 19 | 39 00 | 051 | 42 59 | 091 | 22 58 | 112 | 45 10 | 191 | 25 02 | 213 | 37 14 | 262 | 32 41 | 309 |
| 20 | 39 42 | 051 | 43 53 | 092 | 23 48 | 113 | 44 59 | 193 | 24 32 | 214 | 36 21 | 263 | 31 59 | 309 |
| 21 | 40 24 | 051 | 44 47 | 092 | 24 37 | 113 | 44 46 | 194 | 24 01 | 215 | 35 27 | 263 | 31 17 | 309 |
| 22 | 41 05 | 050 | 45 41 | 093 | 25 27 | 114 | 44 33 | 195 | 23 30 | 216 | 34 33 | 264 | 30 35 | 309 |
| 23 | 41 47 | 050 | 46 35 | 093 | 26 16 | 115 | 44 18 | 197 | 22 59 | 216 | 33 40 | 264 | 29 53 | 309 |
| 24 | 42 28 | 050 | 47 29 | 094 | 27 05 | 115 | 44 02 | 198 | 22 26 | 217 | 32 46 | 265 | 29 11 | 309 |
| 25 | 43 10 | 050 | 48 22 | 094 | 27 53 | 116 | 43 45 | 199 | 21 54 | 218 | 31 52 | 265 | 28 29 | 309 |
| 26 | 43 51 | 050 | 49 16 | 095 | 28 42 | 117 | 43 27 | 200 | 21 20 | 218 | 30 59 | 266 | 27 48 | 309 |
| 27 | 44 33 | 050 | 50 10 | 095 | 29 30 | 117 | 43 08 | 202 | 20 47 | 219 | 30 05 | 266 | 27 06 | 310 |
| 28 | 45 14 | 050 | 51 04 | 096 | 30 17 | 118 | 42 47 | 203 | 20 12 | 220 | 29 11 | 267 | 26 25 | 310 |
| 29 | 45 55 | 050 | 51 57 | 096 | 31 05 | 119 | 42 26 | 204 | 19 37 | 221 | 28 17 | 267 | 25 43 | 310 |
| | CAPELLA | | •ALDEBARAN | | RIGEL | | •Diphda | | Alpheratz | | DENEB | | •Kochab | |
| 30 | 46 36 | 050 | 52 51 | 097 | 31 52 | 119 | 42 04 | 205 | 64 54 | 283 | 25 02 | 310 | 10 35 | 357 |
| 31 | 47 17 | 049 | 53 44 | 098 | 32 39 | 120 | 41 40 | 206 | 64 01 | 283 | 24 21 | 310 | 10 32 | 357 |
| 32 | 47 58 | 049 | 54 38 | 098 | 33 25 | 121 | 41 16 | 207 | 63 09 | 283 | 23 39 | 310 | 10 29 | 357 |
| 33 | 48 39 | 049 | 55 31 | 099 | 34 12 | 122 | 40 51 | 209 | 62 17 | 283 | 22 58 | 311 | 10 26 | 357 |
| 34 | 49 19 | 049 | 56 24 | 099 | 34 57 | 122 | 40 24 | 210 | 61 24 | 283 | 22 18 | 311 | 10 24 | 358 |
| 35 | 50 00 | 048 | 57 17 | 100 | 35 43 | 123 | 39 57 | 211 | 60 32 | 283 | 21 37 | 311 | 10 22 | 358 |
| 36 | 50 40 | 048 | 58 10 | 101 | 36 28 | 124 | 39 29 | 212 | 59 39 | 284 | 20 56 | 311 | 10 20 | 358 |
| 37 | 51 20 | 048 | 59 03 | 102 | 37 12 | 125 | 39 00 | 213 | 58 47 | 284 | 20 16 | 311 | 10 18 | 358 |
| 38 | 52 00 | 048 | 59 56 | 102 | 37 56 | 126 | 38 31 | 214 | 57 54 | 284 | 19 35 | 312 | 10 17 | 359 |
| 39 | 52 40 | 047 | 60 49 | 103 | 38 40 | 126 | 38 00 | 215 | 57 02 | 284 | 18 55 | 312 | 10 16 | 359 |
| 40 | 53 19 | 047 | 61 41 | 104 | 39 23 | 127 | 37 29 | 216 | 56 10 | 284 | 18 15 | 312 | 10 15 | 359 |
| 41 | 53 58 | 046 | 62 33 | 105 | 40 06 | 128 | 36 57 | 217 | 55 17 | 284 | 17 35 | 312 | 10 15 | 000 |
| 42 | 54 37 | 046 | 63 25 | 106 | 40 48 | 129 | 36 24 | 218 | 54 25 | 284 | 16 55 | 313 | 10 14 | 000 |
| 43 | 55 16 | 046 | 64 17 | 107 | 41 29 | 130 | 35 50 | 219 | 53 33 | 284 | 16 16 | 313 | 10 14 | 000 |
| 44 | 55 54 | 045 | 65 09 | 108 | 42 10 | 131 | 35 16 | 220 | 52 40 | 284 | 15 36 | 313 | 10 14 | 000 |
| | •CAPELLA | | PROCYON | | SIRIUS | | •RIGEL | | Acamar | | Diphda | | •Alpheratz | |
| 45 | 56 32 | 045 | 20 40 | 094 | 20 47 | 122 | 42 51 | 132 | 23 37 | 181 | 34 41 | 221 | 51 48 | 285 |
| 46 | 57 10 | 044 | 21 33 | 095 | 21 32 | 122 | 43 30 | 133 | 23 36 | 181 | 34 06 | 222 | 50 56 | 285 |
| 47 | 57 47 | 043 | 22 27 | 095 | 22 18 | 123 | 44 09 | 134 | 23 34 | 182 | 33 30 | 223 | 50 04 | 285 |
| 48 | 58 24 | 043 | 23 21 | 096 | 23 03 | 124 | 44 48 | 135 | 23 32 | 183 | 32 53 | 223 | 49 12 | 285 |
| 49 | 59 00 | 042 | 24 14 | 096 | 23 47 | 124 | 45 25 | 136 | 23 29 | 184 | 32 16 | 224 | 48 20 | 285 |
| 50 | 59 36 | 041 | 25 08 | 097 | 24 32 | 125 | 46 02 | 137 | 23 25 | 185 | 31 38 | 225 | 47 28 | 285 |
| 51 | 60 12 | 041 | 26 02 | 097 | 25 16 | 126 | 46 39 | 138 | 23 20 | 185 | 30 59 | 226 | 46 36 | 286 |
| 52 | 60 47 | 040 | 26 55 | 098 | 25 59 | 126 | 47 14 | 140 | 23 14 | 186 | 30 20 | 227 | 45 44 | 286 |
| 53 | 61 21 | 039 | 27 48 | 098 | 26 43 | 127 | 47 48 | 141 | 23 08 | 187 | 29 41 | 227 | 44 52 | 286 |
| 54 | 61 55 | 038 | 28 42 | 099 | 27 25 | 128 | 48 22 | 142 | 23 01 | 188 | 29 01 | 228 | 44 00 | 286 |
| 55 | 62 28 | 037 | 29 35 | 099 | 28 08 | 129 | 48 55 | 143 | 22 53 | 189 | 28 20 | 229 | 43 08 | 286 |
| 56 | 63 00 | 036 | 30 28 | 100 | 28 50 | 129 | 49 27 | 145 | 22 44 | 190 | 27 40 | 230 | 42 17 | 287 |
| 57 | 63 32 | 035 | 31 21 | 100 | 29 31 | 130 | 49 57 | 146 | 22 35 | 190 | 26 58 | 231 | 41 25 | 287 |
| 58 | 64 02 | 034 | 32 14 | 101 | 30 12 | 131 | 50 27 | 147 | 22 25 | 191 | 26 16 | 231 | 40 33 | 287 |
| 59 | 64 32 | 033 | 33 07 | 101 | 30 53 | 132 | 50 56 | 149 | 22 14 | 192 | 25 34 | 232 | 39 42 | 287 |
| | •Dubhe | | PROCYON | | SIRIUS | | •RIGEL | | Diphda | | •Hamal | | Mirfak | |
| 60 | 15 48 | 028 | 34 00 | 102 | 31 33 | 132 | 51 23 | 150 | 24 51 | 233 | 64 02 | 270 | 65 09 | 346 |
| 61 | 16 14 | 028 | 34 53 | 102 | 32 12 | 133 | 51 50 | 151 | 24 08 | 233 | 63 08 | 271 | 64 55 | 344 |
| 62 | 16 40 | 029 | 35 45 | 103 | 32 51 | 134 | 52 15 | 153 | 23 25 | 234 | 62 14 | 271 | 64 40 | 343 |
| 63 | 17 05 | 029 | 36 38 | 104 | 33 30 | 135 | 52 39 | 154 | 22 41 | 235 | 61 20 | 272 | 64 23 | 341 |
| 64 | 17 32 | 029 | 37 30 | 104 | 34 08 | 136 | 53 02 | 156 | 21 57 | 235 | 60 26 | 272 | 64 06 | 340 |
| 65 | 17 58 | 029 | 38 23 | 105 | 34 45 | 137 | 53 23 | 157 | 21 12 | 236 | 59 32 | 272 | 63 47 | 339 |
| 66 | 18 24 | 029 | 39 15 | 105 | 35 22 | 138 | 53 43 | 159 | 20 28 | 237 | 58 38 | 273 | 63 27 | 338 |
| 67 | 18 51 | 030 | 40 06 | 106 | 35 58 | 138 | 54 02 | 161 | 19 42 | 237 | 57 45 | 273 | 63 06 | 336 |
| 68 | 19 17 | 030 | 40 58 | 107 | 36 33 | 139 | 54 19 | 162 | 18 57 | 238 | 56 51 | 273 | 62 44 | 335 |
| 69 | 19 44 | 030 | 41 50 | 107 | 37 08 | 140 | 54 35 | 164 | 18 11 | 238 | 55 57 | 274 | 62 21 | 334 |
| 70 | 20 11 | 030 | 42 41 | 108 | 37 42 | 141 | 54 49 | 165 | 17 25 | 239 | 55 03 | 274 | 61 57 | 333 |
| 71 | 20 38 | 030 | 43 32 | 109 | 38 16 | 142 | 55 02 | 167 | 16 39 | 240 | 54 09 | 274 | 61 32 | 332 |
| 72 | 21 05 | 030 | 44 23 | 110 | 38 48 | 143 | 55 13 | 169 | 15 52 | 240 | 53 16 | 275 | 61 06 | 331 |
| 73 | 21 32 | 030 | 45 14 | 110 | 39 20 | 144 | 55 23 | 171 | 15 05 | 241 | 52 22 | 275 | 60 39 | 330 |
| 74 | 22 00 | 031 | 46 04 | 111 | 39 51 | 145 | 55 31 | 172 | 14 18 | 241 | 51 28 | 276 | 60 12 | 329 |
| | •Dubhe | | POLLUX | | PROCYON | | •SIRIUS | | RIGEL | | •Hamal | | Mirfak | |
| 75 | 22 27 | 031 | 53 34 | 077 | 46 55 | 112 | 40 21 | 146 | 55 37 | 174 | 50 35 | 276 | 59 44 | 328 |
| 76 | 22 55 | 031 | 54 27 | 077 | 47 45 | 113 | 40 50 | 148 | 55 42 | 176 | 49 41 | 276 | 59 15 | 327 |
| 77 | 23 22 | 031 | 55 20 | 078 | 48 34 | 113 | 41 19 | 149 | 55 45 | 178 | 48 47 | 276 | 58 46 | 327 |
| 78 | 23 50 | 031 | 56 12 | 078 | 49 23 | 114 | 41 47 | 150 | 55 46 | 179 | 47 54 | 277 | 58 16 | 326 |
| 79 | 24 18 | 031 | 57 05 | 078 | 50 12 | 115 | 42 13 | 151 | 55 46 | 181 | 47 00 | 277 | 57 45 | 325 |
| 80 | 24 46 | 031 | 57 58 | 078 | 51 01 | 116 | 42 39 | 152 | 55 44 | 183 | 46 07 | 277 | 57 14 | 324 |
| 81 | 25 14 | 031 | 58 51 | 078 | 51 49 | 117 | 43 04 | 153 | 55 41 | 185 | 45 13 | 278 | 56 42 | 324 |
| 82 | 25 42 | 031 | 59 43 | 078 | 52 37 | 118 | 43 27 | 154 | 55 36 | 186 | 44 20 | 278 | 56 10 | 323 |
| 83 | 26 10 | 031 | 60 36 | 078 | 53 24 | 119 | 43 50 | 156 | 55 29 | 188 | 43 26 | 278 | 55 37 | 322 |
| 84 | 26 38 | 031 | 61 29 | 079 | 54 11 | 120 | 44 12 | 157 | 55 21 | 190 | 42 33 | 279 | 55 04 | 322 |
| 85 | 27 06 | 032 | 62 22 | 079 | 54 58 | 121 | 44 33 | 158 | 55 11 | 192 | 41 40 | 279 | 54 31 | 321 |
| 86 | 27 34 | 032 | 63 15 | 079 | 55 44 | 122 | 44 52 | 159 | 54 59 | 193 | 40 47 | 279 | 53 57 | 321 |
| 87 | 28 03 | 032 | 64 08 | 079 | 56 29 | 123 | 45 10 | 161 | 54 46 | 195 | 39 53 | 280 | 53 22 | 320 |
| 88 | 28 31 | 032 | 65 00 | 079 | 57 14 | 125 | 45 28 | 162 | 54 32 | 197 | 39 00 | 280 | 52 48 | 320 |
| 89 | 28 59 | 032 | 65 53 | 079 | 57 58 | 126 | 45 44 | 163 | 54 15 | 198 | 38 07 | 280 | 52 13 | 319 |

## LAT 26°N

| LHA ♈ | Hc | Zn | Hc | Zn | Hc | Zn | Hc | Zn | Hc | Zn | Hc | Zn | Hc | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Dubhe | | •REGULUS | | PROCYON | | SIRIUS | | •RIGEL | | ALDEBARAN | | •Mirfak | |
| 90 | 29 27 | 032 | 30 26 | 091 | 58 41 | 127 | 45 59 | 165 | 53 58 | 200 | 68 01 | 249 | 51 37 | 319 |
| 91 | 29 56 | 032 | 31 20 | 091 | 59 24 | 129 | 46 12 | 166 | 53 39 | 201 | 67 11 | 250 | 51 02 | 318 |
| 92 | 30 24 | 032 | 32 14 | 092 | 60 05 | 130 | 46 25 | 167 | 53 19 | 203 | 66 20 | 251 | 50 26 | 318 |
| 93 | 30 52 | 032 | 33 08 | 092 | 60 46 | 131 | 46 36 | 169 | 52 57 | 204 | 65 29 | 252 | 49 50 | 318 |
| 94 | 31 21 | 032 | 34 02 | 093 | 61 26 | 133 | 46 46 | 170 | 52 34 | 206 | 64 37 | 253 | 49 13 | 317 |
| 95 | 31 49 | 032 | 34 56 | 093 | 62 05 | 135 | 46 54 | 171 | 52 10 | 207 | 63 45 | 254 | 48 37 | 317 |
| 96 | 32 17 | 032 | 35 50 | 094 | 62 43 | 136 | 47 02 | 173 | 51 44 | 209 | 62 53 | 255 | 48 00 | 317 |
| 97 | 32 45 | 031 | 36 43 | 094 | 63 20 | 138 | 47 08 | 174 | 51 18 | 210 | 62 01 | 256 | 47 23 | 316 |
| 98 | 33 13 | 031 | 37 37 | 095 | 63 55 | 140 | 47 12 | 176 | 50 50 | 212 | 61 09 | 257 | 46 45 | 316 |
| 99 | 33 42 | 031 | 38 31 | 095 | 64 29 | 142 | 47 16 | 177 | 50 21 | 213 | 60 16 | 257 | 46 08 | 316 |
| 100 | 34 10 | 031 | 39 25 | 096 | 65 02 | 144 | 47 18 | 178 | 49 51 | 214 | 59 24 | 258 | 45 30 | 316 |
| 101 | 34 38 | 031 | 40 18 | 096 | 65 33 | 146 | 47 19 | 180 | 49 20 | 216 | 58 31 | 259 | 44 53 | 316 |
| 102 | 35 05 | 031 | 41 12 | 097 | 66 03 | 148 | 47 18 | 181 | 48 48 | 217 | 57 38 | 260 | 44 15 | 315 |
| 103 | 35 33 | 031 | 42 05 | 097 | 66 31 | 150 | 47 16 | 183 | 48 15 | 218 | 56 45 | 260 | 43 37 | 315 |
| 104 | 36 01 | 031 | 42 59 | 098 | 66 57 | 152 | 47 13 | 184 | 47 41 | 219 | 55 52 | 261 | 42 59 | 315 |
| | Dubhe | | •REGULUS | | Alphard | | SIRIUS | | •RIGEL | | ALDEBARAN | | •CAPELLA | |
| 105 | 36 29 | 031 | 43 52 | 098 | 40 22 | 129 | 47 08 | 186 | 47 07 | 221 | 54 58 | 262 | 61 07 | 321 |
| 106 | 36 56 | 031 | 44 45 | 099 | 41 04 | 130 | 47 03 | 187 | 46 31 | 222 | 54 05 | 262 | 60 33 | 320 |
| 107 | 37 23 | 030 | 45 39 | 100 | 41 45 | 131 | 46 55 | 188 | 45 55 | 223 | 53 11 | 263 | 59 58 | 319 |
| 108 | 37 51 | 030 | 46 32 | 100 | 42 25 | 132 | 46 47 | 190 | 45 18 | 224 | 52 18 | 263 | 59 22 | 318 |
| 109 | 38 18 | 030 | 47 25 | 101 | 43 05 | 133 | 46 37 | 191 | 44 40 | 225 | 51 24 | 264 | 58 46 | 318 |
| 110 | 38 45 | 030 | 48 18 | 101 | 43 44 | 134 | 46 26 | 192 | 44 01 | 226 | 50 31 | 264 | 58 09 | 317 |
| 111 | 39 12 | 030 | 49 11 | 102 | 44 22 | 135 | 46 14 | 194 | 43 22 | 227 | 49 37 | 265 | 57 32 | 316 |
| 112 | 39 38 | 030 | 50 03 | 103 | 45 00 | 136 | 46 00 | 195 | 42 42 | 228 | 48 43 | 266 | 56 55 | 316 |
| 113 | 40 05 | 029 | 50 56 | 103 | 45 37 | 137 | 45 46 | 196 | 42 02 | 229 | 47 49 | 266 | 56 17 | 315 |
| 114 | 40 31 | 029 | 51 48 | 104 | 46 13 | 138 | 45 30 | 198 | 41 20 | 230 | 46 56 | 267 | 55 39 | 315 |
| 115 | 40 57 | 029 | 52 40 | 105 | 46 48 | 140 | 45 13 | 199 | 40 39 | 231 | 46 02 | 267 | 55 01 | 314 |
| 116 | 41 23 | 029 | 53 32 | 106 | 47 23 | 141 | 44 55 | 200 | 39 57 | 232 | 45 08 | 268 | 54 22 | 314 |
| 117 | 41 49 | 028 | 54 24 | 106 | 47 56 | 142 | 44 35 | 202 | 39 14 | 233 | 44 14 | 268 | 53 43 | 313 |
| 118 | 42 14 | 028 | 55 16 | 107 | 48 29 | 143 | 44 15 | 203 | 38 31 | 234 | 43 20 | 268 | 53 04 | 313 |
| 119 | 42 40 | 028 | 56 07 | 108 | 49 01 | 145 | 43 53 | 204 | 37 47 | 235 | 42 26 | 269 | 52 24 | 313 |
| | •Dubhe | | REGULUS | | •Alphard | | SIRIUS | | RIGEL | | •ALDEBARAN | | CAPELLA | |
| 120 | 43 05 | 027 | 56 58 | 109 | 49 32 | 146 | 43 31 | 205 | 37 03 | 235 | 41 32 | 269 | 51 44 | 312 |
| 121 | 43 30 | 027 | 57 49 | 110 | 50 01 | 147 | 43 07 | 207 | 36 18 | 236 | 40 38 | 270 | 51 04 | 312 |
| 122 | 43 54 | 027 | 58 40 | 111 | 50 30 | 148 | 42 42 | 208 | 35 33 | 237 | 39 44 | 270 | 50 24 | 312 |
| 123 | 44 18 | 027 | 59 30 | 112 | 50 58 | 150 | 42 17 | 209 | 34 48 | 238 | 38 50 | 271 | 49 44 | 311 |
| 124 | 44 42 | 026 | 60 20 | 113 | 51 24 | 151 | 41 50 | 210 | 34 02 | 239 | 37 57 | 271 | 49 03 | 311 |
| 125 | 45 06 | 026 | 61 10 | 114 | 51 50 | 153 | 41 23 | 211 | 33 16 | 239 | 37 03 | 272 | 48 23 | 311 |
| 126 | 45 29 | 025 | 61 59 | 115 | 52 14 | 154 | 40 54 | 212 | 32 29 | 240 | 36 09 | 272 | 47 42 | 311 |
| 127 | 45 52 | 025 | 62 47 | 116 | 52 37 | 156 | 40 25 | 213 | 31 42 | 241 | 35 15 | 272 | 47 01 | 311 |
| 128 | 46 15 | 025 | 63 36 | 117 | 52 58 | 157 | 39 55 | 214 | 30 55 | 241 | 34 21 | 273 | 46 20 | 310 |
| 129 | 46 37 | 024 | 64 23 | 119 | 53 18 | 159 | 39 24 | 215 | 30 07 | 242 | 33 27 | 273 | 45 39 | 310 |
| 130 | 46 59 | 024 | 65 10 | 120 | 53 37 | 160 | 38 52 | 217 | 29 19 | 243 | 32 33 | 274 | 44 58 | 310 |
| 131 | 47 20 | 023 | 65 57 | 121 | 53 55 | 162 | 38 20 | 218 | 28 31 | 243 | 31 39 | 274 | 44 16 | 310 |
| 132 | 47 41 | 023 | 66 42 | 123 | 54 11 | 164 | 37 47 | 219 | 27 43 | 244 | 30 46 | 274 | 43 35 | 310 |
| 133 | 48 02 | 022 | 67 27 | 125 | 54 25 | 165 | 37 13 | 220 | 26 54 | 245 | 29 52 | 275 | 42 53 | 310 |
| 134 | 48 22 | 022 | 68 11 | 126 | 54 38 | 167 | 36 38 | 220 | 26 05 | 245 | 28 58 | 275 | 42 12 | 310 |
| | Dubhe | | •ARCTURUS | | SPICA | | Alphard | | •SIRIUS | | BETELGEUSE | | •CAPELLA | |
| 135 | 48 42 | 021 | 18 08 | 077 | 15 55 | 111 | 54 50 | 169 | 36 03 | 221 | 42 05 | 256 | 41 30 | 310 |
| 136 | 49 02 | 021 | 19 00 | 077 | 16 45 | 112 | 55 00 | 170 | 35 27 | 222 | 41 13 | 256 | 40 49 | 309 |
| 137 | 49 21 | 020 | 19 53 | 078 | 17 35 | 112 | 55 08 | 172 | 34 50 | 223 | 40 20 | 257 | 40 07 | 309 |
| 138 | 49 39 | 020 | 20 46 | 078 | 18 25 | 113 | 55 15 | 174 | 34 13 | 224 | 39 28 | 258 | 39 25 | 309 |
| 139 | 49 57 | 019 | 21 39 | 078 | 19 15 | 113 | 55 20 | 175 | 33 35 | 225 | 38 35 | 258 | 38 44 | 309 |
| 140 | 50 15 | 019 | 22 31 | 079 | 20 04 | 114 | 55 23 | 177 | 32 57 | 226 | 37 42 | 259 | 38 02 | 309 |
| 141 | 50 32 | 018 | 23 24 | 079 | 20 53 | 114 | 55 25 | 179 | 32 18 | 227 | 36 49 | 259 | 37 20 | 309 |
| 142 | 50 48 | 017 | 24 17 | 079 | 21 42 | 115 | 55 26 | 181 | 31 38 | 227 | 35 56 | 260 | 36 39 | 309 |
| 143 | 51 04 | 017 | 25 10 | 080 | 22 31 | 116 | 55 24 | 182 | 30 58 | 228 | 35 03 | 260 | 35 57 | 309 |
| 144 | 51 19 | 016 | 26 04 | 080 | 23 19 | 116 | 55 21 | 184 | 30 18 | 229 | 34 10 | 261 | 35 15 | 309 |
| 145 | 51 34 | 016 | 26 57 | 081 | 24 08 | 117 | 55 17 | 186 | 29 37 | 230 | 33 17 | 261 | 34 34 | 309 |
| 146 | 51 48 | 015 | 27 50 | 081 | 24 56 | 118 | 55 10 | 188 | 28 55 | 231 | 32 23 | 262 | 33 52 | 310 |
| 147 | 52 01 | 014 | 28 43 | 081 | 25 43 | 118 | 55 02 | 189 | 28 13 | 231 | 31 30 | 262 | 33 11 | 310 |
| 148 | 52 14 | 013 | 29 37 | 082 | 26 31 | 119 | 54 53 | 191 | 27 31 | 232 | 30 36 | 263 | 32 29 | 310 |
| 149 | 52 27 | 013 | 30 30 | 082 | 27 18 | 119 | 54 42 | 193 | 26 48 | 233 | 29 43 | 263 | 31 47 | 310 |
| | Dubhe | | •ARCTURUS | | SPICA | | •Alphard | | SIRIUS | | POLLUX | | •CAPELLA | |
| 150 | 52 38 | 012 | 31 23 | 082 | 28 05 | 120 | 54 29 | 194 | 26 05 | 234 | 59 46 | 282 | 31 06 | 310 |
| 151 | 52 49 | 011 | 32 17 | 083 | 28 51 | 121 | 54 15 | 196 | 25 22 | 234 | 58 53 | 282 | 30 25 | 310 |
| 152 | 52 59 | 011 | 33 10 | 083 | 29 37 | 122 | 54 00 | 198 | 24 38 | 235 | 58 00 | 282 | 29 43 | 310 |
| 153 | 53 09 | 010 | 34 04 | 083 | 30 23 | 122 | 53 43 | 199 | 23 53 | 236 | 57 07 | 282 | 29 02 | 310 |
| 154 | 53 18 | 009 | 34 57 | 084 | 31 08 | 123 | 53 24 | 201 | 23 09 | 236 | 56 15 | 282 | 28 21 | 310 |
| 155 | 53 26 | 008 | 35 51 | 084 | 31 53 | 124 | 53 04 | 202 | 22 24 | 237 | 55 22 | 282 | 27 40 | 310 |
| 156 | 53 34 | 008 | 36 45 | 085 | 32 38 | 124 | 52 43 | 204 | 21 38 | 238 | 54 29 | 283 | 26 59 | 311 |
| 157 | 53 40 | 007 | 37 38 | 085 | 33 22 | 125 | 52 21 | 205 | 20 53 | 238 | 53 37 | 283 | 26 18 | 311 |
| 158 | 53 47 | 006 | 38 32 | 085 | 34 06 | 126 | 51 57 | 207 | 20 07 | 239 | 52 44 | 283 | 25 37 | 311 |
| 159 | 53 52 | 005 | 39 26 | 086 | 34 50 | 127 | 51 32 | 208 | 19 20 | 239 | 51 52 | 283 | 24 56 | 311 |
| 160 | 53 56 | 005 | 40 20 | 086 | 35 33 | 128 | 51 06 | 210 | 18 34 | 240 | 50 59 | 283 | 24 15 | 311 |
| 161 | 54 00 | 004 | 41 14 | 086 | 36 15 | 128 | 50 39 | 211 | 17 47 | 241 | 50 07 | 283 | 23 35 | 311 |
| 162 | 54 03 | 003 | 42 07 | 087 | 36 57 | 129 | 50 10 | 212 | 17 00 | 241 | 49 14 | 284 | 22 54 | 311 |
| 163 | 54 06 | 002 | 43 01 | 087 | 37 38 | 130 | 49 41 | 214 | 16 13 | 242 | 48 22 | 284 | 22 14 | 312 |
| 164 | 54 07 | 001 | 43 55 | 088 | 38 19 | 131 | 49 10 | 215 | 15 25 | 242 | 47 30 | 284 | 21 34 | 312 |
| | •Dubhe | | Alkaid | | ARCTURUS | | •SPICA | | Alphard | | •PROCYON | | POLLUX | |
| 165 | 54 08 | 001 | 50 19 | 043 | 44 49 | 088 | 39 00 | 132 | 48 39 | 216 | 37 37 | 256 | 46 37 | 284 |
| 166 | 54 08 | 000 | 50 55 | 042 | 45 43 | 088 | 39 39 | 133 | 48 06 | 218 | 36 45 | 256 | 45 45 | 284 |
| 167 | 54 08 | 359 | 51 32 | 042 | 46 37 | 089 | 40 19 | 134 | 47 33 | 219 | 35 52 | 257 | 44 53 | 285 |
| 168 | 54 06 | 358 | 52 07 | 041 | 47 31 | 089 | 40 57 | 135 | 46 59 | 220 | 35 00 | 257 | 44 01 | 285 |
| 169 | 54 04 | 357 | 52 43 | 041 | 48 25 | 090 | 41 35 | 136 | 46 24 | 221 | 34 07 | 258 | 43 09 | 285 |
| 170 | 54 01 | 356 | 53 18 | 041 | 49 19 | 090 | 42 12 | 137 | 45 48 | 222 | 33 14 | 259 | 42 17 | 285 |
| 171 | 53 58 | 356 | 53 53 | 040 | 50 13 | 091 | 42 49 | 138 | 45 11 | 223 | 32 21 | 259 | 41 25 | 286 |
| 172 | 53 53 | 355 | 54 28 | 040 | 51 06 | 091 | 43 24 | 139 | 44 33 | 225 | 31 28 | 260 | 40 33 | 286 |
| 173 | 53 48 | 354 | 55 02 | 039 | 52 00 | 092 | 43 59 | 140 | 43 55 | 226 | 30 35 | 260 | 39 41 | 286 |
| 174 | 53 42 | 353 | 55 36 | 038 | 52 54 | 092 | 44 34 | 141 | 43 16 | 227 | 29 42 | 261 | 38 49 | 286 |
| 175 | 53 35 | 353 | 56 09 | 038 | 53 48 | 093 | 45 07 | 142 | 42 37 | 228 | 28 49 | 261 | 37 57 | 286 |
| 176 | 53 28 | 352 | 56 42 | 037 | 54 42 | 093 | 45 39 | 144 | 41 57 | 229 | 27 55 | 262 | 37 06 | 287 |
| 177 | 53 20 | 351 | 57 14 | 037 | 55 36 | 094 | 46 11 | 145 | 41 16 | 230 | 27 02 | 262 | 36 14 | 287 |
| 178 | 53 11 | 350 | 57 46 | 036 | 56 30 | 094 | 46 42 | 146 | 40 35 | 231 | 26 08 | 263 | 35 22 | 287 |
| 179 | 53 02 | 350 | 58 17 | 035 | 57 23 | 095 | 47 11 | 147 | 39 53 | 231 | 25 15 | 263 | 34 31 | 287 |

FIGURE 141.—LAT 26°N.

**TABLE 5—CORRECTION FOR PRECESSION AND NUTATION**

| L.H.A. ♈ | North latitudes | | | | | | | | South latitudes | | | | | | | L.H.A. ♈ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N. 89° | N. 80° | N. 70° | N. 60° | N. 50° | N. 40° | N. 20° | 0° | S. 20° | S. 40° | S. 50° | S. 60° | S. 70° | S. 80° | S. 89° | |
| | | | | | | | | 1977 | | | | | | | | |
| ° | ′ ° | ′ ° | ′ ° | ′ ° | ′ ° | ′ ° | ′ ° | ′ ° | ′ ° | ′ ° | ′ ° | ′ ° | ′ ° | ′ ° | ′ ° | ° |
| 0 | 1 170 | 1 190 | 1 210 | 1 230 | 1 230 | 2 240 | 2 250 | 2 250 | 2 250 | 2 240 | 2 240 | 1 230 | 1 220 | 1 210 | 1 190 | 0 |
| 30 | 1 200 | 1 220 | 1 230 | 1 240 | 2 240 | 2 240 | 2 250 | 2 250 | 2 250 | 1 240 | 1 230 | 1 220 | 1 210 | 1 180 | 1 160 | 30 |
| 60 | 1 230 | 1 240 | 1 250 | 2 250 | 2 250 | 2 250 | 2 260 | 2 250 | 2 250 | 1 240 | 1 230 | 1 220 | 1 190 | 1 150 | 1 130 | 60 |
| 90 | 1 260 | 1 260 | 1 260 | 2 260 | 2 270 | 2 270 | 2 270 | 2 270 | 1 260 | 1 260 | 1 260 | 0 — | 0 — | 0 — | 1 100 | 90 |
| 120 | 1 290 | 1 280 | 1 280 | 2 280 | 2 280 | 2 280 | 2 280 | 2 280 | 1 280 | 1 290 | 1 290 | 0 — | 0 — | 1 060 | 1 070 | 120 |
| 150 | 1 320 | 1 310 | 1 300 | 2 290 | 2 290 | 2 290 | 2 290 | 2 290 | 2 290 | 1 300 | 1 310 | 1 320 | 1 350 | 1 020 | 1 040 | 150 |
| 180 | 1 350 | 1 330 | 1 320 | 1 310 | 2 300 | 2 300 | 2 290 | 2 290 | 2 300 | 2 300 | 1 310 | 1 320 | 1 330 | 1 350 | 1 010 | 180 |
| 210 | 1 020 | 1 000 | 1 330 | 1 320 | 1 310 | 1 300 | 2 300 | 2 290 | 2 290 | 2 300 | 2 300 | 1 300 | 1 310 | 1 320 | 1 340 | 210 |
| 240 | 1 050 | 1 030 | 1 350 | 1 320 | 1 310 | 1 300 | 2 290 | 2 290 | 2 290 | 2 290 | 2 290 | 2 290 | 1 290 | 1 300 | 1 310 | 240 |
| 270 | 1 080 | 0 — | 0 — | 0 — | 1 290 | 1 280 | 1 280 | 2 280 | 2 270 | 2 280 | 2 280 | 2 280 | 1 280 | 1 280 | 1 280 | 270 |
| 300 | 1 110 | 1 120 | 0 — | 0 — | 1 250 | 1 250 | 1 260 | 2 260 | 2 260 | 2 260 | 2 260 | 2 260 | 1 260 | 1 260 | 1 250 | 300 |
| 330 | 1 140 | 1 160 | 1 190 | 1 220 | 1 230 | 1 240 | 2 250 | 2 250 | 2 250 | 2 250 | 2 250 | 2 250 | 1 240 | 1 230 | 1 220 | 330 |
| 360 | 1 170 | 1 190 | 1 210 | 1 230 | 1 230 | 2 240 | 2 250 | 2 250 | 2 250 | 2 240 | 2 240 | 1 230 | 1 220 | 1 210 | 1 190 | 360 |
| | | | | | | | | 1978 | | | | | | | | |
| 0 | 1 160 | 0 — | 1 210 | 1 220 | 1 230 | 1 240 | 1 240 | 1 250 | 1 250 | 1 240 | 1 240 | 1 240 | 1 230 | 1 220 | 1 200 | 0 |
| 30 | 1 190 | 1 210 | 1 220 | 1 230 | 1 240 | 1 240 | 1 250 | 1 250 | 1 240 | 1 240 | 1 230 | 1 220 | 1 210 | 1 190 | 1 170 | 30 |
| 60 | 1 220 | 1 230 | 1 240 | 1 250 | 1 250 | 1 250 | 1 250 | 1 250 | 1 250 | 1 240 | 1 230 | 0 — | 0 — | 0 — | 1 140 | 60 |
| 90 | 1 250 | 1 260 | 1 260 | 1 260 | 1 260 | 1 260 | 1 260 | 1 260 | 1 260 | 1 250 | 0 — | 0 — | 0 — | 0 — | 1 110 | 90 |
| 120 | 1 280 | 1 280 | 1 280 | 1 280 | 1 280 | 1 280 | 1 280 | 1 280 | 1 280 | 1 280 | 0 — | 0 — | 0 — | 0 — | 1 080 | 120 |
| 150 | 1 310 | 1 300 | 1 300 | 1 290 | 1 290 | 1 290 | 1 290 | 1 290 | 1 290 | 1 300 | 1 310 | 0 — | 0 — | 0 — | 1 050 | 150 |
| 180 | 1 340 | 1 320 | 1 310 | 1 310 | 1 300 | 1 300 | 1 290 | 1 290 | 1 300 | 1 300 | 1 310 | 1 320 | 1 330 | 0 — | 1 020 | 180 |
| 210 | 1 010 | 1 350 | 1 330 | 1 320 | 1 310 | 1 300 | 1 300 | 1 290 | 1 300 | 1 300 | 1 300 | 1 310 | 1 320 | 1 330 | 1 350 | 210 |
| 240 | 1 040 | 0 — | 0 — | 0 — | 1 310 | 1 300 | 1 290 | 1 290 | 1 290 | 1 290 | 1 290 | 1 290 | 1 300 | 1 310 | 1 320 | 240 |
| 270 | 1 070 | 0 — | 0 — | 0 — | 0 — | 1 290 | 1 280 | 1 280 | 1 280 | 1 280 | 1 280 | 1 280 | 1 280 | 1 280 | 1 290 | 270 |
| 300 | 1 100 | 0 — | 0 — | 0 — | 0 — | 1 260 | 1 260 | 1 270 | 1 270 | 1 270 | 1 270 | 1 260 | 1 260 | 1 260 | 1 260 | 300 |
| 330 | 1 130 | 0 — | 0 — | 0 — | 1 230 | 1 240 | 1 250 | 1 250 | 1 250 | 1 250 | 1 250 | 1 250 | 1 250 | 1 240 | 1 230 | 330 |
| 360 | 1 160 | 0 — | 1 210 | 1 220 | 1 230 | 1 240 | 1 240 | 1 250 | 1 250 | 1 240 | 1 240 | 1 240 | 1 230 | 1 220 | 1 200 | 360 |
| | | | | | | | | There is no correction for 1979 or 1980 | | | | | | | | |
| | | | | | | | | 1981 | | | | | | | | |
| 0 | 0 — | 0 — | 1 050 | 1 050 | 1 060 | 1 060 | 1 070 | 1 070 | 1 060 | 1 060 | 1 050 | 1 040 | 0 — | 0 — | 0 — | 0 |
| 30 | 0 — | 1 060 | 1 060 | 1 070 | 1 070 | 1 070 | 1 070 | 1 070 | 1 070 | 1 060 | 0 — | 0 — | 0 — | 0 — | 0 — | 30 |
| 60 | 0 — | 1 080 | 1 080 | 1 080 | 1 080 | 1 080 | 1 080 | 1 080 | 1 080 | 0 — | 0 — | 0 — | 0 — | 0 — | 0 — | 60 |
| 90 | 0 — | 1 100 | 1 100 | 1 100 | 1 100 | 1 100 | 1 100 | 1 100 | 1 100 | 0 — | 0 — | 0 — | 0 — | 0 — | 0 — | 90 |
| 120 | 0 — | 1 120 | 1 120 | 1 110 | 1 110 | 1 110 | 1 110 | 1 110 | 1 110 | 1 120 | 0 — | 0 — | 0 — | 0 — | 0 — | 120 |
| 150 | 0 — | 0 — | 1 130 | 1 130 | 1 120 | 1 120 | 1 110 | 1 110 | 1 120 | 1 120 | 1 130 | 1 140 | 0 — | 0 — | 0 — | 150 |
| 180 | 0 — | 0 — | 0 — | 1 140 | 1 130 | 1 120 | 1 120 | 1 110 | 1 110 | 1 120 | 1 120 | 1 130 | 1 140 | 0 — | 0 — | 180 |
| 210 | 0 — | 0 — | 0 — | 0 — | 0 — | 1 120 | 1 110 | 1 110 | 1 110 | 1 110 | 1 110 | 1 110 | 1 120 | 1 130 | 0 — | 210 |
| 240 | 0 — | 0 — | 0 — | 0 — | 0 — | 0 — | 1 100 | 1 100 | 1 100 | 1 100 | 1 100 | 1 100 | 1 100 | 1 100 | 0 — | 240 |
| 270 | 0 — | 0 — | 0 — | 0 — | 0 — | 0 — | 1 080 | 1 080 | 1 090 | 1 090 | 1 080 | 1 080 | 1 080 | 1 080 | 0 — | 270 |
| 300 | 0 — | 0 — | 0 — | 0 — | 0 — | 1 060 | 1 070 | 1 070 | 1 070 | 1 070 | 1 070 | 1 070 | 1 070 | 1 060 | 0 — | 300 |
| 330 | 0 — | 0 — | 0 — | 1 040 | 1 050 | 1 060 | 1 070 | 1 070 | 1 070 | 1 060 | 1 060 | 1 060 | 1 050 | 0 — | 0 — | 330 |
| 360 | 0 — | 0 — | 1 050 | 1 050 | 1 060 | 1 060 | 1 070 | 1 070 | 1 060 | 1 060 | 1 050 | 1 040 | 0 — | 0 — | 0 — | 360 |

The above table gives the correction to be applied to a position line or a fix, *deduced from the tables in this volume*, for the effects of precession and nutation. Each entry consists of a group of four figures of which the first (in bold type) is the distance, in nautical miles, which the position line or fix is to be moved, and the group of three figures is the direction (true bearing). The table is entered firstly by the year, then by choosing the column nearest the latitude and finally the entry nearest the L.H.A.♈ of observation; no interpolation is necessary.

*Example.* In 1977 a fix is obtained in latitude N.23° when L.H.A.♈ is 71°. Entering the table with the year 1977, latitude N.20° and L.H.A.♈ 60° gives 2′ 260° which indicates that the fix is to be transferred 2 miles in true bearing 260°.

FIGURE 142.—Precession and Nutation Correction.

## TABLE 6—CORRECTION (*Q*) FOR *POLARIS*

| L.H.A. ♈ | *Q* | L.H.A. ♈ | *Q* | L.H.A. ♈ | *Q* | L.H.A. ♈ | *Q* | L.H.A. ♈ | *Q* | L.H.A. ♈ | *Q* | L.H.A. ♈ | *Q* | L.H.A. ♈ | *Q* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ° ′ | ′ | ° ′ | ′ | ° ′ | ′ | ° ′ | ′ | ° ′ | ′ | ° ′ | ′ | ° ′ | ′ | ° ′ | ′ |
| 358 16 | −41 | 83 17 | −31 | 116 20 | − 5 | 147 13 | +21 | 192 56 | +47 | 272 28 | +25 | 304 07 | − 1 | 335 51 | −27 |
| 0 20 | −42 | 84 45 | −30 | 117 29 | − 4 | 148 30 | +22 | 196 40 | +48 | 273 49 | +24 | 305 17 | − 2 | 337 13 | −28 |
| 2 30 | −43 | 86 12 | −29 | 118 39 | − 3 | 149 48 | +23 | 201 31 | +49 | 275 08 | +23 | 306 26 | − 3 | 338 37 | −29 |
| 4 49 | −44 | 87 38 | −28 | 119 49 | − 2 | 151 07 | +24 | 224 44 | +48 | 276 27 | +22 | 307 36 | − 4 | 340 03 | −30 |
| 7 20 | −45 | 89 02 | −27 | 120 58 | − 1 | 152 26 | +25 | 229 35 | +47 | 277 45 | +21 | 308 46 | − 5 | 341 30 | −31 |
| 10 06 | −46 | 90 24 | −26 | 122 08 | 0 | 153 47 | +26 | 233 19 | +46 | 279 02 | +20 | 309 55 | − 6 | 342 58 | −32 |
| 13 13 | −47 | 91 45 | −25 | 123 18 | + 1 | 155 09 | +27 | 236 28 | +45 | 280 18 | +19 | 311 05 | − 7 | 344 29 | −33 |
| 16 54 | −48 | 93 06 | −24 | 124 27 | + 2 | 156 32 | +28 | 239 16 | +44 | 281 33 | +18 | 312 15 | − 8 | 346 02 | −34 |
| 21 41 | −49 | 94 25 | −23 | 125 37 | + 3 | 157 57 | +29 | 241 49 | +43 | 282 48 | +17 | 313 26 | − 9 | 347 37 | −35 |
| 44 34 | −48 | 95 43 | −22 | 126 47 | + 4 | 159 23 | +30 | 244 10 | +42 | 284 02 | +16 | 314 36 | −10 | 349 14 | −36 |
| 49 21 | −47 | 97 00 | −21 | 127 56 | + 5 | 160 51 | +31 | 246 22 | +41 | 285 16 | +15 | 315 47 | −11 | 350 55 | −37 |
| 53 02 | −46 | 98 17 | −20 | 129 06 | + 6 | 162 20 | +32 | 248 27 | +40 | 286 29 | +14 | 316 58 | −12 | 352 39 | −38 |
| 56 09 | −45 | 99 32 | −19 | 130 16 | + 7 | 163 52 | +33 | 250 26 | +39 | 287 41 | +13 | 318 10 | −13 | 354 27 | −39 |
| 58 55 | −44 | 100 47 | −18 | 131 26 | + 8 | 165 25 | +34 | 252 19 | +38 | 288 53 | +12 | 319 21 | −14 | 356 19 | −40 |
| 61 26 | −43 | 102 02 | −17 | 132 37 | + 9 | 167 01 | +35 | 254 08 | +37 | 290 05 | +11 | 320 34 | −15 | 358 16 | −41 |
| 63 45 | −42 | 103 15 | −16 | 133 48 | +10 | 168 40 | +36 | 255 53 | +36 | 291 16 | +10 | 321 46 | −16 | 0 20 | −42 |
| 65 55 | −41 | 104 29 | −15 | 134 59 | +11 | 170 22 | +37 | 257 35 | +35 | 292 27 | + 9 | 323 00 | −17 | 2 30 | −43 |
| 67 59 | −40 | 105 41 | −14 | 136 10 | +12 | 172 07 | +38 | 259 14 | +34 | 293 38 | + 8 | 324 13 | −18 | 4 49 | −44 |
| 69 56 | −39 | 106 54 | −13 | 137 22 | +13 | 173 56 | +39 | 260 50 | +33 | 294 49 | + 7 | 325 28 | −19 | 7 20 | −45 |
| 71 48 | −38 | 108 05 | −12 | 138 34 | +14 | 175 49 | +40 | 262 23 | +32 | 295 59 | + 6 | 326 43 | −20 | 10 06 | −46 |
| 73 36 | −37 | 109 17 | −11 | 139 46 | +15 | 177 48 | +41 | 263 55 | +31 | 297 09 | + 5 | 327 58 | −21 | 13 13 | −47 |
| 75 20 | −36 | 110 28 | −10 | 140 59 | +16 | 179 53 | +42 | 265 24 | +30 | 298 19 | + 4 | 329 15 | −22 | 16 54 | −48 |
| 77 01 | −35 | 111 39 | − 9 | 142 13 | +17 | 182 05 | +43 | 266 52 | +29 | 299 28 | + 3 | 330 32 | −23 | 21 41 | −49 |
| 78 38 | −34 | 112 49 | − 8 | 143 27 | +18 | 184 26 | +44 | 268 18 | +28 | 300 38 | + 2 | 331 50 | −24 | 44 34 | −48 |
| 80 13 | −33 | 114 00 | − 7 | 144 42 | +19 | 186 59 | +45 | 269 43 | +27 | 301 48 | + 1 | 333 09 | −25 | 49 21 | −47 |
| 81 46 | −32 | 115 10 | − 6 | 145 57 | +20 | 189 47 | +46 | 271 06 | +26 | 302 57 | 0 | 334 30 | −26 | 53 02 | −46 |
| 83 17 |  | 116 20 |  | 147 13 |  | 192 56 |  | 272 28 |  | 304 07 |  | 335 51 |  | 56 09 |  |

The above table, which does *not* include refraction, gives the quantity *Q* to be applied to the corrected sextant altitude of *Polaris* to give the latitude of the observer. In critical cases ascend.

*Polaris* : Mag. 2·1, S.H.A. 326° 52′, Dec. N.89° 10′·5

## TABLE 7—AZIMUTH OF *POLARIS*

| L.H.A. ♈ | Latitude 0° | 30° | 50° | 55° | 60° | 65° | 70° | L.H.A. ♈ | Latitude 0° | 30° | 50° | 55° | 60° | 65° | 70° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° |
| 0 | 0·5 | 0·5 | 0·7 | 0·8 | 0·9 | 1·1 | 1·4 | 180 | 359·5 | 359·5 | 359·3 | 359·2 | 359·1 | 359·0 | 358·7 |
| 10 | 0·3 | 0·4 | 0·5 | 0·6 | 0·7 | 0·8 | 1·0 | 190 | 359·7 | 359·6 | 359·5 | 359·4 | 359·4 | 359·3 | 359·1 |
| 20 | 0·2 | 0·2 | 0·3 | 0·3 | 0·4 | 0·5 | 0·6 | 200 | 359·8 | 359·8 | 359·7 | 359·7 | 359·6 | 359·6 | 359·5 |
| 30 | 0·0 | 0·1 | 0·1 | 0·1 | 0·1 | 0·1 | 0·1 | 210 | 0·0 | 359·9 | 359·9 | 359·9 | 359·9 | 359·9 | 359·9 |
| 40 | 359·9 | 359·9 | 359·8 | 359·8 | 359·8 | 359·8 | 359·7 | 220 | 0·1 | 0·1 | 0·2 | 0·2 | 0·2 | 0·2 | 0·3 |
| 50 | 359·8 | 359·7 | 359·6 | 359·6 | 359·5 | 359·4 | 359·3 | 230 | 0·2 | 0·3 | 0·4 | 0·4 | 0·5 | 0·5 | 0·7 |
| 60 | 359·6 | 359·6 | 359·4 | 359·3 | 359·2 | 359·1 | 358·9 | 240 | 0·4 | 0·4 | 0·6 | 0·6 | 0·7 | 0·9 | 1·1 |
| 70 | 359·5 | 359·4 | 359·2 | 359·1 | 359·0 | 358·8 | 358·5 | 250 | 0·5 | 0·6 | 0·8 | 0·8 | 1·0 | 1·1 | 1·4 |
| 80 | 359·4 | 359·3 | 359·1 | 358·9 | 358·8 | 358·5 | 358·2 | 260 | 0·6 | 0·7 | 0·9 | 1·0 | 1·2 | 1·4 | 1·7 |
| 90 | 359·3 | 359·2 | 358·9 | 358·8 | 358·6 | 358·3 | 357·9 | 270 | 0·7 | 0·8 | 1·1 | 1·2 | 1·4 | 1·6 | 2·0 |
| 100 | 359·2 | 359·1 | 358·8 | 358·7 | 358·5 | 358·2 | 357·7 | 280 | 0·8 | 0·9 | 1·2 | 1·3 | 1·5 | 1·8 | 2·2 |
| 110 | 359·2 | 359·1 | 358·7 | 358·6 | 358·4 | 358·1 | 357·6 | 290 | 0·8 | 0·9 | 1·2 | 1·4 | 1·6 | 1·9 | 2·3 |
| 120 | 359·2 | 359·0 | 358·7 | 358·6 | 358·4 | 358·0 | 357·6 | 300 | 0·8 | 1·0 | 1·3 | 1·4 | 1·6 | 1·9 | 2·4 |
| 130 | 359·2 | 359·1 | 358·7 | 358·6 | 358·4 | 358·1 | 357·6 | 310 | 0·8 | 0·9 | 1·3 | 1·4 | 1·6 | 1·9 | 2·4 |
| 140 | 359·2 | 359·1 | 358·8 | 358·6 | 358·4 | 358·1 | 357·7 | 320 | 0·8 | 0·9 | 1·2 | 1·4 | 1·6 | 1·9 | 2·3 |
| 150 | 359·3 | 359·2 | 358·9 | 358·7 | 358·5 | 358·3 | 357·9 | 330 | 0·7 | 0·9 | 1·2 | 1·3 | 1·5 | 1·8 | 2·2 |
| 160 | 359·3 | 359·2 | 359·0 | 358·9 | 358·7 | 358·5 | 358·1 | 340 | 0·7 | 0·8 | 1·0 | 1·2 | 1·3 | 1·6 | 2·0 |
| 170 | 359·4 | 359·4 | 359·1 | 359·0 | 358·9 | 358·7 | 358·4 | 350 | 0·6 | 0·7 | 0·9 | 1·0 | 1·1 | 1·4 | 1·7 |
| 180 | 359·5 | 359·5 | 359·3 | 359·2 | 359·1 | 359·0 | 358·7 | 360 | 0·5 | 0·5 | 0·7 | 0·8 | 0·9 | 1·1 | 1·4 |

When Cassiopeia is left (right), *Polaris* is west (east).

FIGURE 143.—Polaris Correction.

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## TABLE 8—REFRACTION

TO BE *SUBTRACTED* FROM SEXTANT ALTITUDE

| *R* | (a) Height in thousands of feet | | | | | | | | | | | | *R* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | |
| ′ | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ′ |
| | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | |
| 0 | | | | | | | | | | | | | 0 |
| | 63 | 59 | 55 | 51 | 46 | 41 | 36 | 31 | 26 | 20 | 17 | 13 | |
| 1 | | | | | | | | | | | | | 1 |
| | 33 | 29 | 26 | 22 | 19 | 16 | 14 | 11 | 10 | 10 | 10 | 10 | |
| 2 | | | | | | | | | | | | | 2 |
| | 21 | 19 | 16 | 14 | 12 | 10 | 10 | 10 | | | | | |
| 3 | | | | | | | | | | | | | 3 |
| | 16 | 14 | 12 | 10 | 10 | | | | | | | | |
| 4 | | | | | | | | | | | | | 4 |
| | 12 | 11 | 10 | | | | | | | | | | |
| 5 | | | | | | | | | | | | | 5 |
| | 10 | 10 | | | | | | | | | | | |

| *R* | (b) Height in thousands of metres | | | | | | | | | | | | | | | | | | | | *R* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | |
| ′ | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ′ |
| | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | |
| 0 | | | | | | | | | | | | | | | | | | | | | 0 |
| | 63 | 61 | 58 | 55 | 53 | 50 | 46 | 43 | 40 | 37 | 33 | 30 | 26 | 23 | 20 | 17 | 15 | 13 | 11 | 10 | |
| 1 | | | | | | | | | | | | | | | | | | | | | 1 |
| | 33 | 31 | 28 | 26 | 24 | 21 | 19 | 17 | 16 | 14 | 12 | 11 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | | |
| 2 | | | | | | | | | | | | | | | | | | | | | 2 |
| | 21 | 20 | 18 | 16 | 15 | 13 | 12 | 11 | 10 | 10 | 10 | 10 | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | | | | | 3 |
| | 16 | 14 | 13 | 12 | 11 | 10 | 10 | 10 | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | | | | 4 |
| | 12 | 11 | 10 | 10 | 10 | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | | | | 5 |
| | 10 | 10 | | | | | | | | | | | | | | | | | | | |

Choose the column appropriate to height, in units of 1000 feet in table 8(a) or in units of 1000 metres in table 8(b), and find the range of altitude in which the sextant altitude lies; the corresponding value of *R* is the refraction to be subtracted from the sextant altitude.

## TABLE 9—CORIOLIS (*Z*) CORRECTION

### STANDARD DOME REFRACTION

To be *subtracted* from sextant altitude when using sextant suspension in a perspex dome.

| Alt. | Refn. | Alt. | Refn. |
|---|---|---|---|
| ° | ′ | ° | ′ |
| 10 | 8 | 50 | 4 |
| 20 | 7 | 60 | 4 |
| 30 | 6 | 70 | 3 |
| 40 | 5 | 80 | 3 |

This table must not be used if a calibration table is fitted to the dome, or if a flat glass plate is provided, or for non-standard domes.

| Ground speed knots | Latitude | | | | | | | | | | Ground speed knots |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0° | 10° | 20° | 30° | 40° | 50° | 60° | 70° | 80° | 90° | |
| | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | |
| 50 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 50 |
| 100 | 0 | 0 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 100 |
| 150 | 0 | 1 | 1 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 150 |
| 200 | 0 | 1 | 2 | 3 | 3 | 4 | 5 | 5 | 5 | 5 | 200 |
| 250 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 6 | 6 | 7 | 250 |
| 300 | 0 | 1 | 3 | 4 | 5 | 6 | 7 | 7 | 8 | 8 | 300 |
| 350 | 0 | 2 | 3 | 5 | 6 | 7 | 8 | 9 | 9 | 9 | 350 |
| 400 | 0 | 2 | 4 | 5 | 7 | 8 | 9 | 10 | 10 | 10 | 400 |
| 450 | 0 | 2 | 4 | 6 | 8 | 9 | 10 | 11 | 12 | 12 | 450 |
| 500 | 0 | 2 | 4 | 7 | 8 | 10 | 11 | 12 | 13 | 13 | 500 |
| 550 | 0 | 3 | 5 | 7 | 9 | 11 | 12 | 14 | 14 | 14 | 550 |
| 600 | 0 | 3 | 5 | 8 | 10 | 12 | 14 | 15 | 16 | 16 | 600 |
| 650 | 0 | 3 | 6 | 9 | 11 | 13 | 15 | 16 | 17 | 17 | 650 |
| 700 | 0 | 3 | 6 | 9 | 12 | 14 | 16 | 17 | 18 | 18 | 700 |
| 750 | 0 | 3 | 7 | 10 | 13 | 15 | 17 | 18 | 19 | 20 | 750 |
| 800 | 0 | 4 | 7 | 10 | 13 | 16 | 18 | 20 | 21 | 21 | 800 |
| 850 | 0 | 4 | 8 | 11 | 14 | 17 | 19 | 21 | 22 | 22 | 850 |
| 900 | 0 | 4 | 8 | 12 | 15 | 18 | 20 | 22 | 23 | 24 | 900 |

Apply by moving the position line a distance *Z* to starboard (right) of the track in northern latitudes, and to port (left) in southern latitudes.

### BUBBLE SEXTANT ERROR

Sextant No.

| Alt. | Corr. |
|---|---|
| ° | ′ |

FIGURE 144.—Refraction and Coriolis.

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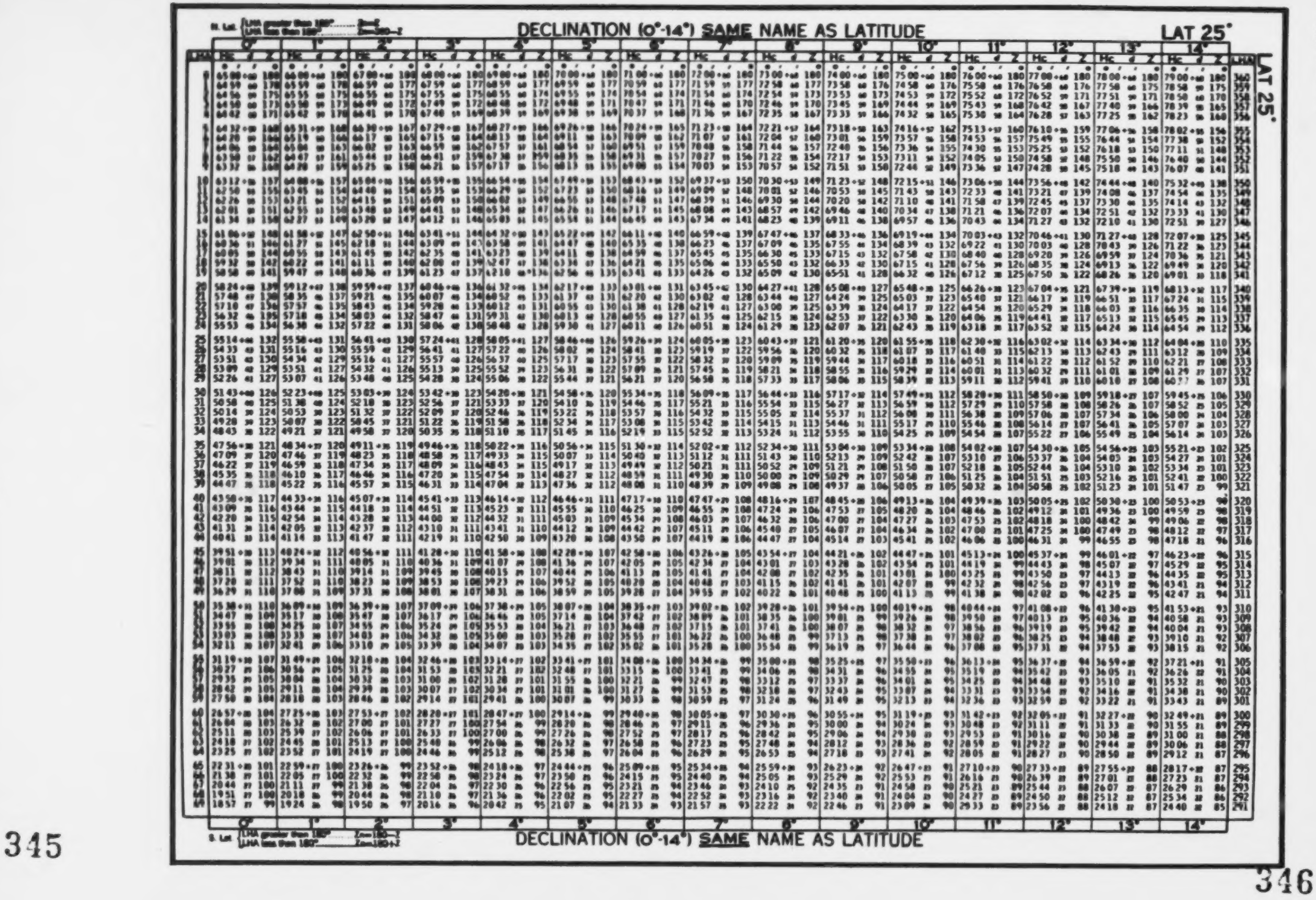


N. Lat. {LHA greater than 180°..........Zn=Z
LHA less than 180°..........Zn=360−Z}

DECLINATION (0°-14°) SAME NAME AS LATITUDE

LAT 25°

S. Lat. {LHA greater than 180°..........Zn=180−Z
LHA less than 180°..........Zn=180+Z}

345

346

FIGURE 145.—Declination (0° - 14°) LAT 25°.

## DECLINATION (0°-14°) SAME NAME AS LATITUDE

N. Lat. {LHA greater than 180° ..... Zn=Z; LHA less than 180° ..... Zn=360−Z

| LHA | 0° |  |  | 1° |  |  | 2° |  |  | 3° |  |  | 4° |  |  | 5° |  |  | 6° |  |  | 7° |  |  | 8° |  |  | 9° |  |  | 10° |  |  | 11° |  |  | 12° |  |  | 13° |  |  | 14° |  |  | LHA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z |  |
|  | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° |  |
| 70 | 18 04 | +26 | 99 | 18 30 | +26 | 98 | 18 56 | +26 | 97 | 19 22 | +26 | 96 | 19 48 | +25 | 95 | 20 13 | +25 | 94 | 20 38 | +25 | 93 | 21 03 | +24 | 92 | 21 27 | +24 | 91 | 21 51 | +24 | 90 | 22 15 | +23 | 89 | 22 38 | +23 | 88 | 23 01 | +23 | 87 | 23 24 | +22 | 86 | 23 46 | +22 | 85 | 290 |
| 71 | 17 10 | 26 | 98 | 17 36 | 26 | 97 | 18 02 | 26 | 96 | 18 28 | 26 | 95 | 18 54 | 25 | 95 | 19 19 | 25 | 94 | 19 44 | 25 | 93 | 20 09 | 24 | 92 | 20 33 | 24 | 91 | 20 57 | 24 | 90 | 21 21 | 23 | 89 | 21 44 | 23 | 88 | 22 07 | 23 | 87 | 22 30 | 22 | 86 | 22 52 | 22 | 85 | 289 |
| 72 | 16 16 | 26 | 98 | 16 42 | 26 | 97 | 17 08 | 26 | 96 | 17 34 | 25 | 95 | 17 59 | 26 | 94 | 18 25 | 25 | 93 | 18 50 | 24 | 92 | 19 14 | 25 | 91 | 19 39 | 24 | 90 | 20 03 | 23 | 89 | 20 26 | 24 | 88 | 20 50 | 23 | 87 | 21 13 | 22 | 86 | 21 35 | 23 | 85 | 21 58 | 22 | 84 | 288 |
| 73 | 15 22 | 26 | 97 | 15 48 | 26 | 96 | 16 14 | 26 | 96 | 16 40 | 25 | 95 | 17 05 | 25 | 94 | 17 30 | 25 | 93 | 17 55 | 25 | 92 | 18 20 | 24 | 91 | 18 44 | 24 | 90 | 19 08 | 24 | 89 | 19 32 | 23 | 88 | 19 55 | 23 | 87 | 20 18 | 23 | 86 | 20 41 | 23 | 85 | 21 04 | 22 | 84 | 287 |
| 74 | 14 28 | 26 | 97 | 14 54 | 26 | 96 | 15 20 | 26 | 95 | 15 46 | 25 | 94 | 16 11 | 25 | 93 | 16 36 | 25 | 92 | 17 01 | 25 | 91 | 17 26 | 24 | 90 | 17 50 | 24 | 89 | 18 14 | 24 | 88 | 18 38 | 23 | 87 | 19 01 | 23 | 86 | 19 24 | 23 | 86 | 19 47 | 23 | 85 | 20 10 | 22 | 84 | 286 |
| 75 | 13 34 | +26 | 97 | 14 00 | +26 | 96 | 14 26 | +25 | 95 | 14 51 | +26 | 94 | 15 17 | +25 | 93 | 15 42 | +25 | 92 | 16 07 | +24 | 91 | 16 31 | +24 | 90 | 16 55 | +25 | 89 | 17 20 | +23 | 88 | 17 43 | +24 | 87 | 18 07 | +23 | 86 | 18 30 | +23 | 85 | 18 53 | +23 | 84 | 19 16 | +22 | 83 | 285 |
| 76 | 12 40 | 26 | 96 | 13 06 | 26 | 95 | 13 32 | 25 | 94 | 13 57 | 25 | 93 | 14 22 | 25 | 92 | 14 47 | 25 | 91 | 15 12 | 25 | 90 | 15 37 | 24 | 90 | 16 01 | 24 | 89 | 16 25 | 24 | 88 | 16 49 | 24 | 87 | 17 13 | 23 | 86 | 17 36 | 23 | 85 | 17 59 | 23 | 84 | 18 22 | 22 | 83 | 284 |
| 77 | 11 46 | 26 | 96 | 12 12 | 25 | 95 | 12 37 | 26 | 94 | 13 03 | 25 | 93 | 13 28 | 25 | 92 | 13 53 | 25 | 91 | 14 18 | 24 | 90 | 14 42 | 25 | 89 | 15 07 | 24 | 88 | 15 31 | 24 | 87 | 15 55 | 23 | 86 | 16 18 | 24 | 85 | 16 42 | 23 | 84 | 17 05 | 23 | 83 | 17 28 | 22 | 82 | 283 |
| 78 | 10 52 | 25 | 95 | 11 17 | 26 | 94 | 11 43 | 25 | 93 | 12 08 | 26 | 92 | 12 34 | 25 | 91 | 12 59 | 24 | 91 | 13 23 | 25 | 90 | 13 48 | 24 | 89 | 14 12 | 25 | 88 | 14 37 | 24 | 87 | 15 01 | 23 | 86 | 15 24 | 24 | 85 | 15 48 | 23 | 84 | 16 11 | 23 | 83 | 16 34 | 23 | 82 | 282 |
| 79 | 09 58 | 25 | 95 | 10 23 | 26 | 94 | 10 49 | 25 | 93 | 11 14 | 25 | 92 | 11 39 | 25 | 91 | 12 04 | 25 | 90 | 12 29 | 25 | 89 | 12 54 | 24 | 88 | 13 18 | 24 | 87 | 13 42 | 24 | 86 | 14 06 | 24 | 85 | 14 30 | 24 | 84 | 14 54 | 23 | 84 | 15 17 | 23 | 83 | 15 40 | 23 | 82 | 281 |
| 80 | 09 03 | +26 | 94 | 09 29 | +25 | 93 | 09 54 | +26 | 92 | 10 20 | +25 | 92 | 10 45 | +25 | 91 | 11 10 | +25 | 90 | 11 35 | +24 | 89 | 11 59 | +25 | 88 | 12 24 | +24 | 87 | 12 48 | +24 | 86 | 13 12 | +24 | 85 | 13 36 | +24 | 84 | 14 00 | +23 | 83 | 14 23 | +23 | 82 | 14 46 | +23 | 81 | 280 |
| 81 | 08 09 | 26 | 94 | 08 35 | 25 | 93 | 09 00 | 25 | 92 | 09 25 | 26 | 91 | 09 51 | 24 | 90 | 10 15 | 25 | 89 | 10 40 | 25 | 88 | 11 05 | 25 | 87 | 11 30 | 24 | 87 | 11 54 | 24 | 86 | 12 18 | 24 | 85 | 12 42 | 24 | 84 | 13 06 | 23 | 83 | 13 29 | 24 | 82 | 13 53 | 23 | 81 | 279 |
| 82 | 07 15 | 25 | 93 | 07 40 | 26 | 93 | 08 06 | 25 | 92 | 08 31 | 25 | 91 | 08 56 | 25 | 90 | 09 21 | 25 | 89 | 09 46 | 25 | 88 | 10 11 | 24 | 87 | 10 35 | 25 | 86 | 11 00 | 24 | 85 | 11 24 | 24 | 84 | 11 48 | 24 | 83 | 12 12 | 23 | 82 | 12 35 | 24 | 81 | 12 59 | 23 | 80 | 278 |
| 83 | 06 21 | 25 | 93 | 06 46 | 25 | 92 | 07 11 | 26 | 91 | 07 37 | 25 | 90 | 08 02 | 25 | 89 | 08 27 | 25 | 88 | 08 52 | 24 | 88 | 09 16 | 25 | 87 | 09 41 | 24 | 86 | 10 05 | 25 | 85 | 10 30 | 24 | 84 | 10 54 | 24 | 83 | 11 18 | 24 | 82 | 11 42 | 23 | 81 | 12 05 | 24 | 80 | 277 |
| 84 | 05 26 | 26 | 93 | 05 52 | 25 | 92 | 06 17 | 25 | 91 | 06 42 | 25 | 90 | 07 07 | 25 | 89 | 07 32 | 25 | 88 | 07 57 | 25 | 87 | 08 22 | 25 | 86 | 08 47 | 24 | 85 | 09 11 | 25 | 84 | 09 36 | 24 | 83 | 10 00 | 24 | 82 | 10 24 | 24 | 82 | 10 48 | 24 | 81 | 11 12 | 23 | 80 | 276 |
| 85 | 04 32 | +25 | 92 | 04 57 | +26 | 91 | 05 23 | +25 | 90 | 05 48 | +25 | 89 | 06 13 | +25 | 89 | 06 38 | +25 | 88 | 07 03 | +25 | 87 | 07 28 | +25 | 86 | 07 53 | +24 | 85 | 08 17 | +25 | 84 | 08 42 | +24 | 83 | 09 06 | +24 | 82 | 09 30 | +24 | 81 | 09 54 | +24 | 80 | 10 18 | +24 | 79 | 275 |
| 86 | 03 37 | 26 | 92 | 04 03 | 25 | 91 | 04 28 | 25 | 90 | 04 53 | 26 | 89 | 05 19 | 25 | 88 | 05 44 | 25 | 87 | 06 09 | 25 | 86 | 06 34 | 25 | 85 | 06 59 | 24 | 84 | 07 23 | 25 | 84 | 07 48 | 24 | 83 | 08 12 | 25 | 82 | 08 37 | 24 | 81 | 09 01 | 24 | 80 | 09 25 | 24 | 79 | 274 |
| 87 | 02 43 | 25 | 91 | 03 08 | 26 | 90 | 03 34 | 25 | 89 | 03 59 | 25 | 89 | 04 24 | 25 | 88 | 04 49 | 26 | 87 | 05 15 | 25 | 86 | 05 40 | 24 | 85 | 06 04 | 25 | 84 | 06 29 | 25 | 83 | 06 54 | 25 | 82 | 07 19 | 24 | 81 | 07 43 | 24 | 80 | 08 07 | 25 | 79 | 08 32 | 24 | 79 | 273 |
| 88 | 01 49 | 25 | 91 | 02 14 | 25 | 90 | 02 39 | 26 | 89 | 03 05 | 25 | 88 | 03 30 | 25 | 87 | 03 55 | 25 | 86 | 04 20 | 25 | 85 | 04 45 | 25 | 84 | 05 10 | 25 | 84 | 05 35 | 25 | 83 | 06 00 | 25 | 82 | 06 25 | 24 | 81 | 06 49 | 25 | 80 | 07 14 | 24 | 79 | 07 38 | 25 | 78 | 272 |
| 89 | 00 54 | 26 | 90 | 01 20 | 25 | 90 | 01 45 | 25 | 89 | 02 10 | 26 | 88 | 02 36 | 25 | 87 | 03 01 | 25 | 86 | 03 26 | 25 | 85 | 03 51 | 25 | 84 | 04 16 | 25 | 83 | 04 41 | 25 | 82 | 05 06 | 25 | 81 | 05 31 | 25 | 80 | 05 56 | 25 | 80 | 06 21 | 24 | 79 | 06 45 | 25 | 78 | 271 |
| 90 | 00 00 | +25 | 90 | 00 25 | +26 | 89 | 00 51 | +25 | 88 | 01 16 | +25 | 87 | 01 41 | +26 | 86 | 02 07 | +25 | 85 | 02 32 | +25 | 85 | 02 57 | +25 | 84 | 03 22 | +25 | 83 | 03 47 | +26 | 82 | 04 13 | +25 | 81 | 04 38 | +25 | 80 | 05 03 | +24 | 79 | 05 27 | +25 | 78 | 05 52 | +25 | 77 | 270 |
| 91 | -0 54 | 25 | 90 | -0 29 | 25 | 89 | -0 04 | 26 | 88 | 00 22 | 25 | 87 | 00 47 | 25 | 86 | 01 12 | 26 | 85 | 01 38 | 25 | 84 | 02 03 | 25 | 83 | 02 28 | 26 | 82 | 02 54 | 25 | 81 | 03 19 | 25 | 81 | 03 44 | 25 | 80 | 04 09 | 25 | 79 | 04 34 | 25 | 78 | 04 59 | 25 | 77 | 269 |
| 92 | -1 49 | 26 | 89 | -1 23 | 25 | 88 | -0 58 | 25 | 87 | -0 33 | 26 | 86 | -0 07 | 25 | 86 | 00 18 | 26 | 85 | 00 44 | 25 | 84 | 01 09 | 26 | 83 | 01 35 | 25 | 82 | 02 00 | 25 | 81 | 02 25 | 26 | 80 | 02 51 | 25 | 79 | 03 16 | 25 | 78 | 03 41 | 25 | 77 | 04 06 | 25 | 76 | 268 |
| 93 | -2 43 | 25 | 89 | -2 18 | 26 | 88 | -1 52 | 25 | 87 | -1 27 | 26 | 86 | -1 01 | 25 | 85 | -0 36 | 26 | 84 | -0 10 | 25 | 83 | 00 15 | 26 | 82 | 00 41 | 25 | 81 | 01 06 | 26 | 81 | 01 32 | 25 | 80 | 01 57 | 26 | 79 | 02 23 | 25 | 78 | 02 48 | 25 | 77 | 03 13 | 26 | 76 | 267 |
| 94 | -3 37 | 25 | 88 | -3 12 | 25 | 87 | -2 47 | 26 | 86 | -2 21 | 26 | 86 | -1 55 | 25 | 85 | -1 30 | 26 | 84 | -1 04 | 25 | 83 | -0 39 | 26 | 82 | -0 13 | 26 | 81 | 00 13 | 25 | 80 | 00 38 | 26 | 79 | 01 04 | 25 | 78 | 01 29 | 26 | 77 | 01 55 | 26 | 77 | 02 21 | 25 | 76 | 266 |
| 95 | -4 32 | +26 | 88 | -4 06 | +25 | 87 | -3 41 | +26 | 86 | -3 15 | +25 | 85 | -2 50 | +26 | 84 | -2 24 | +26 | 83 | -1 58 | +26 | 82 | -1 32 | +25 | 82 | -1 07 | +26 | 81 | -0 41 | +26 | 80 | -0 15 | +26 | 79 | 00 11 | +25 | 78 | 00 36 | +26 | 77 | 01 02 | +26 | 76 | 01 28 | +26 | 75 | 265 |
| 96 | -5 26 | 25 | 87 | -5 01 | 26 | 87 | -4 35 | 26 | 86 | -4 09 | 25 | 85 | -3 44 | 26 | 84 | -3 18 | 26 | 83 | -2 52 | 26 | 82 | -2 26 | 26 | 81 | -2 00 | 26 | 80 | -1 34 | 26 | 79 | -1 08 | 26 | 78 | -0 42 | 26 | 78 | -0 16 | 25 | 77 | 00 09 | 26 | 76 | 00 35 | 26 | 75 | 264 |
| 97 | -6 21 | 26 | 87 | -5 55 | 26 | 86 | -5 29 | 25 | 85 | -5 04 | 26 | 84 | -4 38 | 26 | 83 | -4 12 | 26 | 82 | -3 46 | 26 | 82 | -3 20 | 26 | 81 | -2 54 | 26 | 80 | -2 28 | 26 | 79 | -2 02 | 27 | 78 | -1 35 | 26 | 77 | -1 09 | 26 | 76 | -0 43 | 26 | 75 | -0 17 | 26 | 74 | 263 |
| 98 |  |  |  |  |  |  | -6 23 | 25 | 85 | -5 58 | 26 | 84 | -5 32 | 26 | 83 | -5 06 | 26 | 82 | -4 40 | 26 | 81 | -4 14 | 27 | 80 | -3 47 | 26 | 79 | -3 21 | 26 | 78 | -2 55 | 27 | 78 | -2 28 | 26 | 77 | -2 02 | 26 | 76 | -1 36 | 27 | 75 | -1 09 | 26 | 74 | 262 |
| 99 |  |  |  |  |  |  |  |  |  |  |  |  | -6 26 | 26 | 82 | -6 00 | 27 | 82 | -5 33 | 26 | 81 | -5 07 | 26 | 80 | -4 41 | 27 | 79 | -4 14 | 26 | 78 | -3 48 | 27 | 77 | -3 21 | 26 | 76 | -2 55 | 27 | 75 | -2 28 | 27 | 74 | -2 01 | 26 | 74 | 261 |
| 100 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | -6 27 | +26 | 80 | -6 01 | +27 | 79 | -5 34 | +26 | 78 | -5 08 | +27 | 78 | -4 41 | +27 | 77 | -4 14 | +27 | 76 | -3 47 | +26 | 75 | -3 21 | +27 | 74 | -2 54 | +27 | 73 | 260 |
| 101 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | -6 27 | 26 | 78 | -6 01 | 27 | 77 | -5 34 | 27 | 76 | -5 07 | 27 | 75 | -4 40 | 27 | 74 | -4 13 | 27 | 74 | -3 46 | 28 | 73 | 259 |
| 102 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | -6 27 | 28 | 76 | -5 59 | 27 | 75 | -5 32 | 27 | 74 | -5 05 | 28 | 73 | -4 37 | 27 | 72 | 258 |
| 103 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | -6 24 | 27 | 73 | -5 57 | 28 | 73 | -5 29 | 28 | 72 | 257 |
| 104 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | -6 21 | 28 | 71 | 256 |

| LHA | 0° |  |  | 1° |  |  | 2° |  |  | 3° |  |  | 4° |  |  | 5° |  |  | 6° |  |  | 7° |  |  | 8° |  |  | 9° |  |  | 10° |  |  | 11° |  |  | 12° |  |  | 13° |  |  | 14° |  |  | LHA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 97 | -6 21 | 25 | 87 | -6 46 | 25 | 88 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 263 |
| 96 | -5 26 | 26 | 87 | -5 52 | 25 | 88 | -6 17 | 25 | 89 | -6 42 | 25 | 91 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 264 |
| 95 | -4 32 | -25 | 88 | -4 57 | -26 | 89 | -5 23 | -25 | 90 | -5 48 | -25 | 91 | -6 13 | -25 | 91 | -6 38 | -25 | 92 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 265 |
| 94 | -3 37 | 26 | 88 | -4 03 | 25 | 89 | -4 28 | 25 | 90 | -4 53 | 26 | 91 | -5 19 | 25 | 92 | -5 44 | 25 | 93 | -6 09 | 25 | 94 | -6 34 | 25 | 95 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 266 |
| 93 | -2 43 | 25 | 89 | -3 08 | 26 | 90 | -3 34 | 25 | 91 | -3 59 | 25 | 91 | -4 24 | 25 | 92 | -4 49 | 26 | 93 | -5 15 | 25 | 94 | -5 40 | 24 | 95 | -6 04 | 25 | 96 | -6 29 | 25 | 97 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 267 |
| 92 | -1 49 | 25 | 89 | -2 14 | 25 | 90 | -2 39 | 26 | 91 | -3 05 | 25 | 92 | -3 30 | 25 | 93 | -3 55 | 25 | 94 | -4 20 | 25 | 95 | -4 45 | 25 | 96 | -5 10 | 25 | 96 | -5 35 | 25 | 97 | -6 00 | 25 | 98 | -6 25 | 26 | 99 |  |  |  |  |  |  |  |  |  | 268 |
| 91 | -0 54 | 26 | 90 | -1 20 | 25 | 90 | -1 45 | 25 | 91 | -2 10 | 26 | 92 | -2 36 | 25 | 93 | -3 01 | 25 | 94 | -3 26 | 25 | 95 | -3 51 | 25 | 96 | -4 16 | 25 | 97 | -4 41 | 25 | 98 | -5 06 | 25 | 99 | -5 31 | 25 | 100 | -5 56 | 25 | 100 | -6 21 | 24 | 101 | -6 45 | 25 | 102 | 269 |
| 90 | 00 00 | -25 | 90 | -0 25 | -26 | 91 | -0 51 | -25 | 92 | -1 16 | -25 | 93 | -1 41 | -26 | 94 | -2 07 | -25 | 95 | -2 32 | -25 | 95 | -2 57 | -25 | 96 | -3 22 | -25 | 97 | -3 47 | -26 | 98 | -4 13 | -25 | 99 | -4 38 | -25 | 100 | -5 03 | -24 | 101 | -5 27 | -25 | 102 | -5 52 | -25 | 103 | 270 |
| 89 | 00 54 | 25 | 90 | 00 29 | 25 | 91 | 00 04 | 26 | 92 | -0 22 | 25 | 93 | -0 47 | 25 | 94 | -1 12 | 26 | 95 | -1 38 | 25 | 96 | -2 03 | 25 | 97 | -2 28 | 26 | 98 | -2 54 | 25 | 99 | -3 19 | 25 | 99 | -3 44 | 25 | 100 | -4 09 | 25 | 101 | -4 34 | 25 | 102 | -4 59 | 25 | 103 | 271 |
| 88 | 01 49 | 26 | 91 | 01 23 | 25 | 92 | 00 58 | 25 | 93 | 00 33 | 26 | 94 | 00 07 | 25 | 94 | -0 18 | 26 | 95 | -0 44 | 25 | 96 | -1 09 | 26 | 97 | -1 35 | 25 | 98 | -2 00 | 25 | 99 | -2 25 | 26 | 100 | -2 51 | 25 | 101 | -3 16 | 25 | 102 | -3 41 | 25 | 103 | -4 06 | 25 | 104 | 272 |
| 87 | 02 43 | 25 | 91 | 02 18 | 26 | 92 | 01 52 | 25 | 93 | 01 27 | 26 | 94 | 01 01 | 25 | 95 | 00 36 | 26 | 96 | 00 10 | 25 | 97 | -0 15 | 26 | 98 | -0 41 | 25 | 99 | -1 06 | 26 | 99 | -1 32 | 25 | 100 | -1 57 | 26 | 101 | -2 23 | 25 | 102 | -2 48 | 25 | 103 | -3 13 | 26 | 104 | 273 |
| 86 | 03 37 | 25 | 92 | 03 12 | 25 | 93 | 02 47 | 26 | 94 | 02 21 | 26 | 94 | 01 55 | 25 | 95 | 01 30 | 26 | 96 | 01 04 | 25 | 97 | 00 39 | 26 | 98 | 00 13 | 26 | 99 | -0 13 | 25 | 100 | -0 38 | 26 | 101 | -1 04 | 25 | 102 | -1 29 | 26 | 103 | -1 55 | 26 | 103 | -2 21 | 25 | 104 | 274 |
| 85 | 04 32 | -26 | 92 | 04 06 | -25 | 93 | 03 41 | -26 | 94 | 03 15 | -25 | 95 | 02 50 | -26 | 96 | 02 24 | -26 | 97 | 01 58 | -26 | 98 | 01 32 | -25 | 98 | 01 07 | -26 | 99 | 00 41 | -26 | 100 | 00 15 | -26 | 101 | -0 11 | -25 | 102 | -0 36 | -26 | 103 | -1 02 | -26 | 104 | -1 28 | -26 | 105 | 275 |
| 84 | 05 26 | 25 | 93 | 05 01 | 26 | 94 | 04 35 | 26 | 94 | 04 09 | 25 | 95 | 03 44 | 26 | 96 | 03 18 | 26 | 97 | 02 52 | 26 | 98 | 02 26 | 26 | 99 | 02 00 | 26 | 100 | 01 34 | 26 | 101 | 01 08 | 26 | 102 | 00 42 | 26 | 102 | 00 16 | 25 | 103 | -0 09 | 26 | 104 | -0 35 | 26 | 105 | 276 |
| 83 | 06 21 | 26 | 93 | 05 55 | 26 | 94 | 05 29 | 25 | 95 | 05 04 | 26 | 96 | 04 38 | 26 | 97 | 04 12 | 26 | 98 | 03 46 | 26 | 98 | 03 20 | 26 | 99 | 02 54 | 26 | 100 | 02 28 | 26 | 101 | 02 02 | 27 | 102 | 01 35 | 26 | 103 | 01 09 | 26 | 104 | 00 43 | 26 | 105 | 00 17 | 26 | 106 | 277 |
| 82 | 07 15 | 26 | 93 | 06 49 | 26 | 94 | 06 23 | 25 | 95 | 05 58 | 26 | 96 | 05 32 | 26 | 97 | 05 06 | 26 | 98 | 04 40 | 26 | 99 | 04 14 | 27 | 100 | 03 47 | 26 | 101 | 03 21 | 26 | 102 | 02 55 | 27 | 102 | 02 28 | 26 | 103 | 02 02 | 26 | 104 | 01 36 | 27 | 105 | 01 09 | 26 | 106 | 278 |
| 81 | 08 09 | 26 | 94 | 07 43 | 25 | 95 | 07 18 | 26 | 96 | 06 52 | 26 | 97 | 06 26 | 26 | 98 | 06 00 | 27 | 98 | 05 33 | 26 | 99 | 05 07 | 26 | 100 | 04 41 | 27 | 101 | 04 14 | 26 | 102 | 03 48 | 27 | 103 | 03 21 | 26 | 104 | 02 55 | 27 | 105 | 02 28 | 27 | 106 | 02 01 | 26 | 106 | 279 |
| 80 | 09 03 | -25 | 94 | 08 38 | -26 | 95 | 08 12 | -26 | 96 | 07 46 | -26 | 97 | 07 20 | -27 | 98 | 06 53 | -26 | 99 | 06 27 | -26 | 100 | 06 01 | -27 | 101 | 05 34 | -26 | 102 | 05 08 | -27 | 102 | 04 41 | -27 | 103 | 04 14 | -27 | 104 | 03 47 | -26 | 105 | 03 21 | -27 | 106 | 02 54 | -27 | 107 | 280 |
| 79 | 09 58 | 26 | 95 | 09 32 | 26 | 96 | 09 06 | 26 | 97 | 08 40 | 27 | 97 | 08 13 | 26 | 98 | 07 47 | 26 | 99 | 07 21 | 27 | 100 | 06 54 | 27 | 101 | 06 27 | 26 | 102 | 06 01 | 27 | 103 | 05 34 | 27 | 104 | 05 07 | 27 | 105 | 04 40 | 27 | 106 | 04 13 | 27 | 106 | 03 46 | 28 | 107 | 281 |
| 78 | 10 52 | 26 | 95 | 10 26 | 26 | 96 | 10 00 | 26 | 97 | 09 34 | 27 | 98 | 09 07 | 26 | 99 | 08 41 | 27 | 100 | 08 14 | 27 | 101 | 07 47 | 26 | 102 | 07 21 | 27 | 102 | 06 54 | 27 | 103 | 06 27 | 28 | 104 | 05 59 | 27 | 105 | 05 32 | 27 | 106 | 05 05 | 28 | 107 | 04 37 | 27 | 108 | 282 |
| 77 | 11 46 | 26 | 96 | 11 20 | 26 | 97 | 10 54 | 27 | 97 | 10 27 | 26 | 98 | 10 01 | 27 | 99 | 09 34 | 26 | 100 | 09 08 | 27 | 101 | 08 41 | 27 | 102 | 08 14 | 28 | 103 | 07 46 | 27 | 104 | 07 19 | 27 | 105 | 06 52 | 28 | 106 | 06 24 | 27 | 107 | 05 57 | 28 | 107 | 05 29 | 28 | 108 | 283 |
| 76 | 12 40 | 26 | 96 | 12 14 | 26 | 97 | 11 48 | 27 | 98 | 11 21 | 26 | 99 | 10 55 | 27 | 100 | 10 28 | 27 | 101 | 10 01 | 27 | 102 | 09 34 | 27 | 102 | 09 07 | 28 | 103 | 08 39 | 27 | 104 | 08 12 | 28 | 105 | 07 44 | 28 | 106 | 07 16 | 27 | 107 | 06 49 | 28 | 108 | 06 21 | 28 | 109 | 284 |
| 75 | 13 34 | -26 | 97 | 13 08 | -27 | 97 | 12 41 | -26 | 98 | 12 15 | -27 | 99 | 11 48 | -27 | 100 | 11 21 | -27 | 101 | 10 54 | -27 | 102 | 10 27 | -28 | 103 | 09 59 | -27 | 104 | 09 32 | -28 | 105 | 09 04 | -28 | 106 | 08 36 | -28 | 107 | 08 08 | -28 | 107 | 07 40 | -28 | 108 | 07 12 | -28 | 109 | 285 |
| 74 | 14 28 | 26 | 97 | 14 02 | 27 | 98 | 13 35 | 26 | 99 | 13 09 | 27 | 100 | 12 42 | 27 | 101 | 12 15 | 28 | 102 | 11 47 | 27 | 102 | 11 20 | 28 | 103 | 10 52 | 28 | 104 | 10 24 | 28 | 105 | 09 56 | 28 | 106 | 09 28 | 28 | 107 | 09 00 | 28 | 108 | 08 32 | 29 | 109 | 08 03 | 28 | 110 | 286 |
| 73 | 15 22 | 26 | 97 | 14 56 | 27 | 98 | 14 29 | 27 | 99 | 14 02 | 27 | 100 | 13 35 | 27 | 101 | 13 08 | 28 | 102 | 12 40 | 27 | 103 | 12 13 | 28 | 104 | 11 45 | 28 | 105 | 11 17 | 28 | 106 | 10 49 | 29 | 107 | 10 20 | 28 | 107 | 09 52 | 29 | 108 | 09 23 | 28 | 109 | 08 55 | 29 | 110 | 287 |
| 72 | 16 16 | 27 | 98 | 15 49 | 26 | 99 | 15 23 | 27 | 100 | 14 56 | 28 | 101 | 14 28 | 27 | 102 | 14 01 | 28 | 102 | 13 33 | 28 | 103 | 13 05 | 28 | 104 | 12 37 | 28 | 105 | 12 09 | 28 | 106 | 11 41 | 29 | 107 | 11 12 | 29 | 108 | 10 43 | 28 | 109 | 10 15 | 29 | 110 | 09 46 | 30 | 111 | 288 |
| 71 | 17 10 | 27 | 98 | 16 43 | 27 | 99 | 16 16 | 27 | 100 | 15 49 | 27 | 101 | 15 22 | 28 | 102 | 14 54 | 28 | 103 | 14 26 | 28 | 104 | 13 58 | 28 | 105 | 13 30 | 29 | 106 | 13 01 | 28 | 107 | 12 33 | 29 | 108 | 12 04 | 29 | 108 | 11 35 | 29 | 109 | 11 06 | 30 | 110 | 10 36 | 29 | 111 | 289 |
| 70 | 18 04 | -27 | 99 | 17 37 | -27 | 100 | 17 10 | -28 | 101 | 16 42 | -27 | 102 | 16 15 | -28 | 103 | 15 47 | -28 | 103 | 15 19 | -28 | 104 | 14 51 | -29 | 105 | 14 22 | -29 | 106 | 13 53 | -28 | 107 | 13 25 | -30 | 108 | 12 55 | -29 | 109 | 12 26 | -29 | 110 | 11 57 | -30 | 111 | 11 27 | -30 | 112 | 290 |
|  | 0° |  |  | 1° |  |  | 2° |  |  | 3° |  |  | 4° |  |  | 5° |  |  | 6° |  |  | 7° |  |  | 8° |  |  | 9° |  |  | 10° |  |  | 11° |  |  | 12° |  |  | 13° |  |  | 14° |  |  |  |

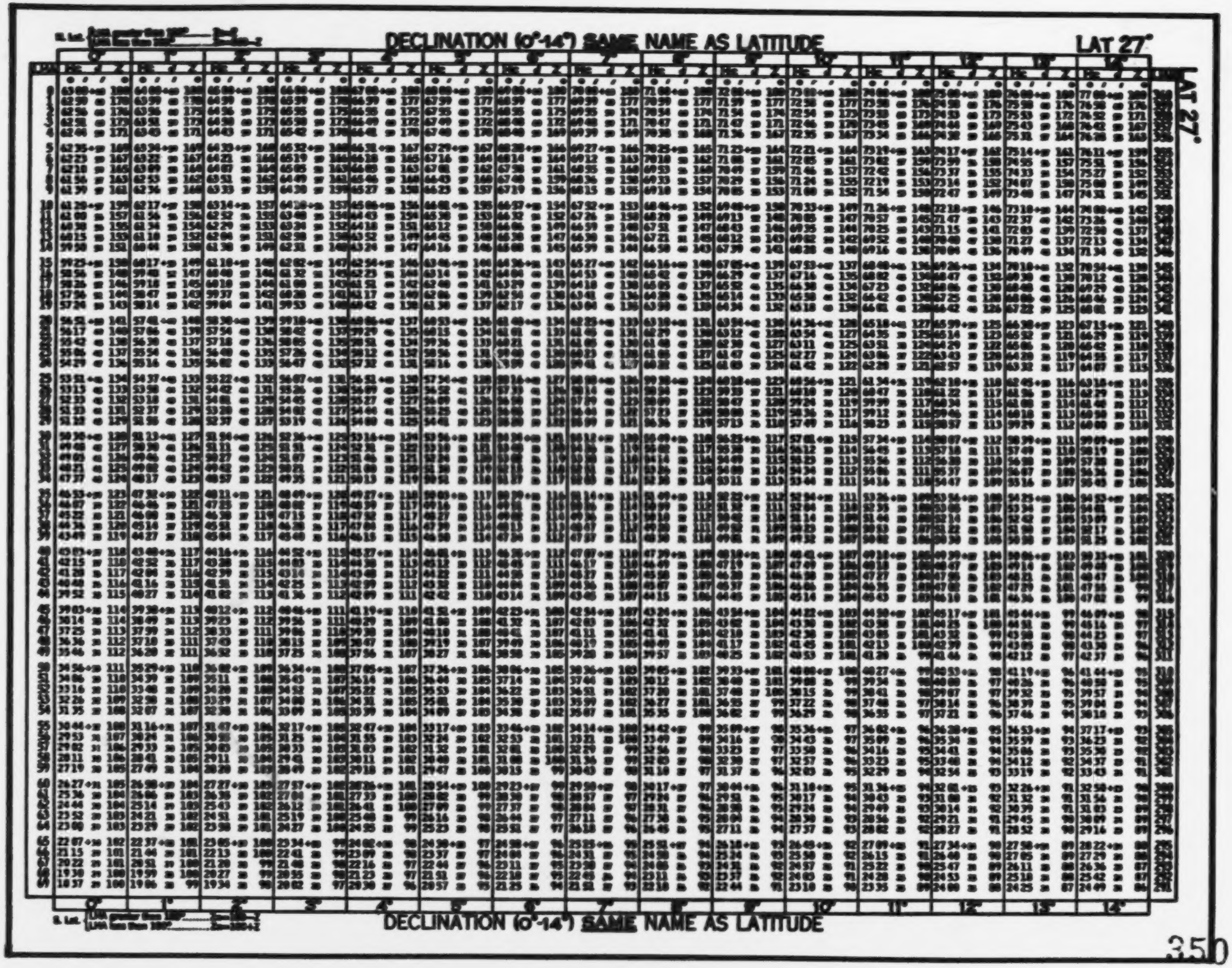
S. Lat. {LHA greater than 180° ..... Zn=180−Z; LHA less than 180° ..... Zn=180+Z

## DECLINATION (0°-14°) CONTRARY NAME TO LATITUDE

LAT 25°

LAT 25°

FIGURE 146.—Declination (0° - 14°) LAT 25°.

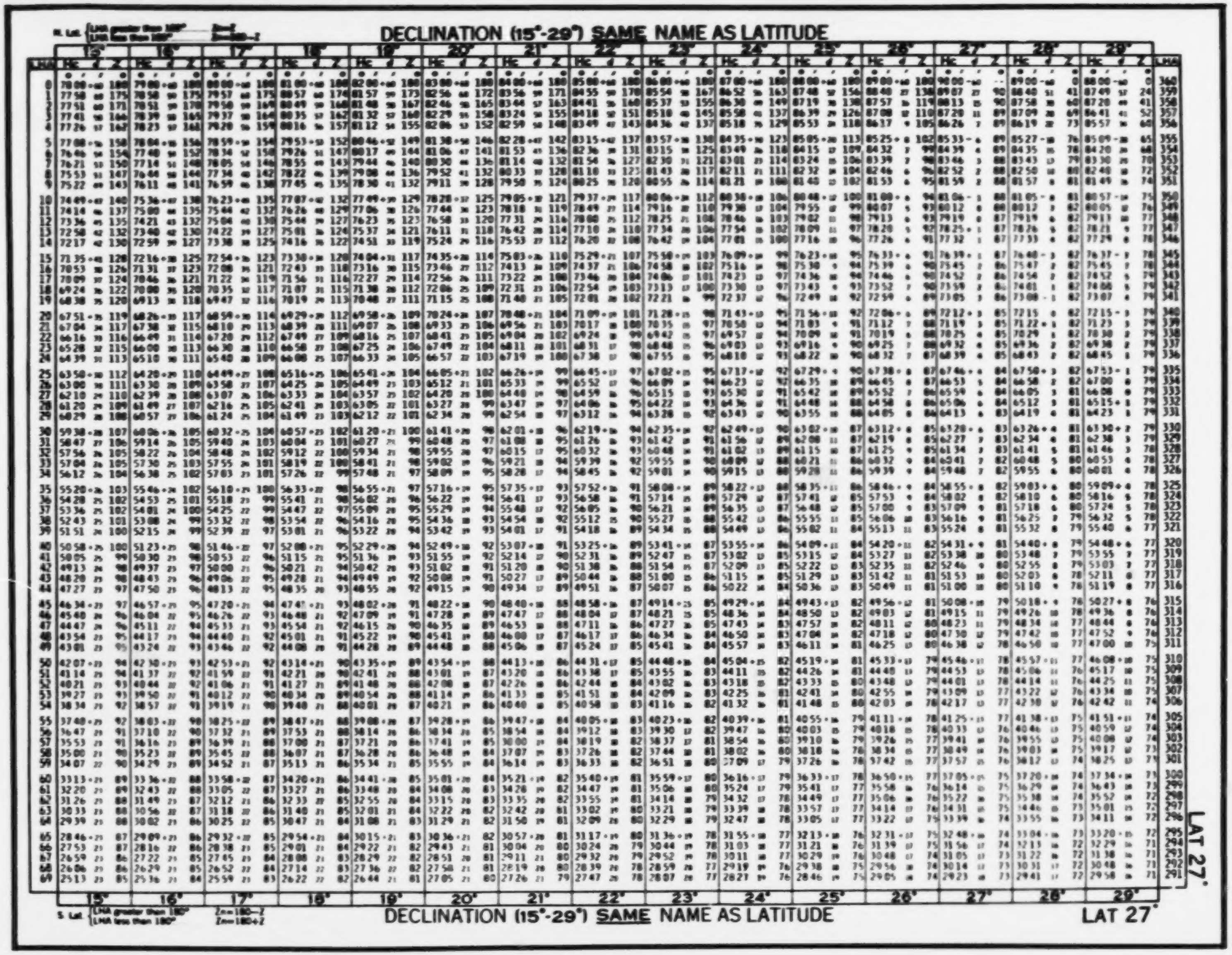


DECLINATION (0°-14°) SAME NAME AS LATITUDE

LAT 27°

0°
1°
2°
3°
4°
5°
6°
7°
8°
9°
10°
11°
12°
13°
14°
LHA
Hc d Z

FIGURE 147.—Declination (0° - 14°) LAT 27°.


N. Lat. {LHA greater than 180° ..... Zn=Z; LHA less than 180° ..... Zn=360−Z}

DECLINATION (15°-29°) SAME NAME AS LATITUDE

15°
16°
17°
18°
19°
20°
21°
22°
23°
24°
25°
26°
27°
28°
29°
LHA
Hc
d
Z
LAT 27°

S. Lat. {LHA greater than 180° ..... Zn=180−Z; LHA less than 180° ..... Zn=180+Z}

DECLINATION (15°-29°) SAME NAME AS LATITUDE

LAT 27°

FIGURE 148.—Declination (15° - 29°) LAT 27°.

N. Lat. {LHA greater than 180° .......... Zn=Z
{LHA less than 180° .......... Zn=360−Z

## DECLINATION (0°-14°) SAME NAME AS LATITUDE

| | 0° | | | 1° | | | 2° | | | 3° | | | 4° | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LHA | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z |
| | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° |
| 70 | 17 03 | +32 | 101 | 17 35 | +32 | 100 | 18 07 | +32 | 99 | 18 39 | +31 | 98 | 19 10 | +31 | 97 |
| 71 | 16 12 | 32 | 100 | 16 44 | 32 | 99 | 17 16 | 32 | 98 | 17 48 | 31 | 97 | 18 19 | 31 | 97 |
| 72 | 15 22 | 32 | 100 | 15 54 | 31 | 99 | 16 25 | 32 | 98 | 16 57 | 31 | 97 | 17 28 | 31 | 96 |
| 73 | 14 31 | 32 | 99 | 15 03 | 31 | 98 | 15 34 | 32 | 97 | 16 06 | 31 | 96 | 16 37 | 31 | 95 |
| 74 | 13 40 | 32 | 98 | 14 12 | 31 | 98 | 14 43 | 32 | 97 | 15 15 | 31 | 96 | 15 46 | 31 | 95 |
| 75 | 12 49 | +32 | 98 | 13 21 | +31 | 97 | 13 52 | +31 | 96 | 14 23 | +31 | 95 | 14 54 | +31 | 94 |
| 76 | 11 58 | 32 | 97 | 12 30 | 31 | 96 | 13 01 | 31 | 96 | 13 32 | 31 | 95 | 14 03 | 31 | 94 |
| 77 | 11 07 | 32 | 97 | 11 39 | 31 | 96 | 12 10 | 31 | 95 | 12 41 | 31 | 94 | 13 12 | 31 | 93 |
| 78 | 10 16 | 31 | 96 | 10 47 | 32 | 95 | 11 19 | 31 | 95 | 11 50 | 30 | 94 | 12 20 | 31 | 93 |
| 79 | 09 25 | 31 | 96 | 09 56 | 31 | 95 | 10 27 | 31 | 94 | 10 58 | 31 | 93 | 11 29 | 31 | 92 |
| 80 | 08 34 | +31 | 95 | 09 05 | +31 | 94 | 09 36 | +31 | 94 | 10 07 | +31 | 93 | 10 38 | +30 | 92 |
| 81 | 07 42 | 32 | 95 | 08 14 | 31 | 94 | 08 45 | 30 | 93 | 09 15 | 31 | 92 | 09 46 | 31 | 91 |
| 82 | 06 51 | 31 | 94 | 07 22 | 31 | 93 | 07 53 | 31 | 92 | 08 24 | 31 | 92 | 08 55 | 30 | 91 |
| 83 | 06 00 | 31 | 94 | 06 31 | 31 | 93 | 07 02 | 31 | 92 | 07 33 | 30 | 91 | 08 03 | 31 | 90 |
| 84 | 05 08 | 31 | 93 | 05 39 | 31 | 92 | 06 10 | 31 | 91 | 06 41 | 31 | 91 | 07 12 | 31 | 90 |
| 85 | 04 17 | +31 | 93 | 04 48 | +31 | 92 | 05 19 | +31 | 91 | 05 50 | +31 | 90 | 06 21 | +30 | 89 |
| 86 | 03 26 | 31 | 92 | 03 57 | 30 | 91 | 04 27 | 31 | 90 | 04 58 | 31 | 89 | 05 29 | 31 | 89 |
| 87 | 02 34 | 31 | 92 | 03 05 | 31 | 91 | 03 36 | 31 | 90 | 04 07 | 31 | 89 | 04 38 | 30 | 88 |
| 88 | 01 43 | 31 | 91 | 02 14 | 31 | 90 | 02 45 | 30 | 89 | 03 15 | 31 | 88 | 03 46 | 31 | 88 |
| 89 | 00 51 | 31 | 91 | 01 22 | 31 | 90 | 01 53 | 31 | 89 | 02 24 | 31 | 88 | 02 55 | 31 | 87 |
| 90 | 00 00 | +31 | 90 | 00 31 | +31 | 89 | 01 02 | +31 | 88 | 01 33 | +31 | 87 | 02 04 | +30 | 87 |
| 91 | −0 51 | 30 | 89 | −0 21 | 31 | 89 | 00 10 | 31 | 88 | 00 41 | 31 | 87 | 01 12 | 31 | 86 |
| 92 | −1 43 | 31 | 89 | −1 12 | 31 | 88 | −0 41 | 31 | 87 | −0 10 | 31 | 86 | 00 21 | 31 | 86 |
| 93 | −2 34 | 31 | 88 | −2 03 | 31 | 88 | −1 32 | 31 | 87 | −1 01 | 31 | 86 | −0 30 | 31 | 85 |
| 94 | −3 26 | 31 | 88 | −2 55 | 31 | 87 | −2 24 | 31 | 86 | −1 53 | 31 | 85 | −1 22 | 32 | 85 |
| 95 | −4 17 | +31 | 87 | −3 46 | +31 | 87 | −3 15 | +31 | 86 | −2 44 | +31 | 85 | −2 13 | +31 | 84 |
| 96 | −5 08 | 31 | 87 | −4 37 | 31 | 86 | −4 06 | 31 | 85 | −3 35 | 31 | 84 | −3 04 | 31 | 83 |
| 97 | −6 00 | 31 | 86 | −5 29 | 32 | 86 | −4 57 | 31 | 85 | −4 26 | 31 | 84 | −3 55 | 31 | 83 |
| 98 | | | | −6 20 | 31 | 85 | −5 49 | 32 | 84 | −5 17 | 31 | 83 | −4 46 | 32 | 82 |
| 99 | | | | | | | −6 40 | 32 | 84 | −6 08 | 31 | 83 | −5 37 | 32 | 82 |
| 100 | | | | | | | | | | | | | −6 28 | +32 | 81 |

| | 5° | | | 6° | | | 7° | | | 8° | | | 9° | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LHA | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z |
| | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° |
| 70 | 19 41 | +31 | 96 | 20 12 | +31 | 95 | 20 43 | +30 | 94 | 21 13 | +30 | 93 | 21 43 | +30 | 93 |
| 71 | 18 50 | 31 | 96 | 19 21 | 31 | 95 | 19 52 | 30 | 94 | 20 22 | 30 | 93 | 20 52 | 30 | 92 |
| 72 | 17 59 | 31 | 95 | 18 30 | 30 | 94 | 19 00 | 31 | 93 | 19 31 | 30 | 92 | 20 01 | 29 | 91 |
| 73 | 17 08 | 31 | 95 | 17 39 | 30 | 94 | 18 09 | 30 | 93 | 18 39 | 30 | 92 | 19 09 | 30 | 91 |
| 74 | 16 17 | 30 | 94 | 16 47 | 31 | 93 | 17 18 | 30 | 92 | 17 48 | 30 | 91 | 18 18 | 29 | 90 |
| 75 | 15 25 | +31 | 94 | 15 56 | +30 | 93 | 16 26 | +30 | 92 | 16 56 | +30 | 91 | 17 26 | +30 | 90 |
| 76 | 14 34 | 30 | 93 | 15 04 | 31 | 92 | 15 35 | 30 | 91 | 16 05 | 30 | 90 | 16 35 | 30 | 89 |
| 77 | 13 43 | 30 | 92 | 14 13 | 30 | 92 | 14 43 | 31 | 91 | 15 14 | 30 | 90 | 15 44 | 29 | 89 |
| 78 | 12 51 | 31 | 92 | 13 22 | 30 | 91 | 13 52 | 30 | 90 | 14 22 | 30 | 89 | 14 52 | 30 | 88 |
| 79 | 12 00 | 30 | 91 | 12 30 | 31 | 91 | 13 01 | 30 | 90 | 13 31 | 30 | 89 | 14 01 | 29 | 88 |
| 80 | 11 08 | +31 | 91 | 11 39 | +30 | 90 | 12 09 | +30 | 89 | 12 39 | +30 | 88 | 13 09 | +30 | 87 |
| 81 | 10 17 | 30 | 90 | 10 47 | 31 | 89 | 11 18 | 30 | 89 | 11 48 | 30 | 88 | 12 18 | 30 | 87 |
| 82 | 09 25 | 31 | 90 | 09 56 | 30 | 89 | 10 26 | 31 | 88 | 10 57 | 30 | 87 | 11 27 | 30 | 86 |
| 83 | 08 34 | 31 | 89 | 09 05 | 30 | 88 | 09 35 | 30 | 88 | 10 05 | 30 | 87 | 10 35 | 30 | 86 |
| 84 | 07 43 | 30 | 89 | 08 13 | 31 | 88 | 08 44 | 30 | 87 | 09 14 | 30 | 86 | 09 44 | 30 | 85 |
| 85 | 06 51 | +31 | 88 | 07 22 | +30 | 87 | 07 52 | +31 | 87 | 08 23 | +30 | 86 | 08 53 | +30 | 85 |
| 86 | 06 00 | 30 | 88 | 06 30 | 31 | 87 | 07 01 | 30 | 86 | 07 31 | 31 | 85 | 08 02 | 30 | 84 |
| 87 | 05 08 | 31 | 87 | 05 39 | 31 | 86 | 06 10 | 30 | 86 | 06 40 | 30 | 85 | 07 10 | 31 | 84 |
| 88 | 04 17 | 31 | 87 | 04 48 | 30 | 86 | 05 18 | 31 | 85 | 05 49 | 30 | 84 | 06 19 | 31 | 83 |
| 89 | 03 26 | 30 | 86 | 03 56 | 31 | 85 | 04 27 | 31 | 85 | 04 58 | 30 | 84 | 05 28 | 31 | 83 |
| 90 | 02 34 | +31 | 86 | 03 05 | +31 | 85 | 03 36 | +31 | 84 | 04 07 | +30 | 83 | 04 37 | +31 | 82 |
| 91 | 01 43 | 31 | 85 | 02 14 | 31 | 84 | 02 45 | 31 | 83 | 03 16 | 30 | 83 | 03 46 | 31 | 82 |
| 92 | 00 52 | 31 | 85 | 01 23 | 31 | 84 | 01 54 | 31 | 83 | 02 25 | 30 | 82 | 02 55 | 31 | 81 |
| 93 | 00 01 | 31 | 84 | 00 32 | 31 | 83 | 01 03 | 31 | 82 | 01 34 | 31 | 82 | 02 05 | 31 | 81 |
| 94 | −0 50 | 31 | 84 | −0 19 | 31 | 83 | 00 12 | 31 | 82 | 00 43 | 31 | 81 | 01 14 | 31 | 80 |
| 95 | −1 42 | +32 | 83 | −1 10 | +31 | 82 | −0 39 | +31 | 81 | −0 08 | +31 | 81 | 00 23 | +32 | 80 |
| 96 | −2 33 | 32 | 83 | −2 01 | 31 | 82 | −1 30 | 31 | 81 | −0 59 | 32 | 80 | −0 27 | 31 | 79 |
| 97 | −3 24 | 32 | 82 | −2 52 | 31 | 81 | −2 21 | 32 | 80 | −1 49 | 31 | 80 | −1 18 | 32 | 79 |
| 98 | −4 14 | 31 | 82 | −3 43 | 32 | 81 | −3 11 | 31 | 80 | −2 40 | 32 | 79 | −2 08 | 32 | 78 |
| 99 | −5 05 | 31 | 81 | −4 34 | 32 | 80 | −4 02 | 32 | 79 | −3 30 | 32 | 79 | −2 58 | 31 | 78 |
| 100 | −5 56 | +32 | 81 | −5 24 | +32 | 80 | −4 52 | +31 | 79 | −4 21 | +32 | 78 | −3 49 | +32 | 77 |
| 101 | | | | −6 15 | 32 | 79 | −5 43 | 32 | 78 | −5 11 | 32 | 77 | −4 39 | 33 | 77 |
| 102 | | | | | | | −6 33 | 32 | 78 | −6 01 | 32 | 77 | −5 29 | 33 | 76 |
| 103 | | | | | | | | | | | | | −6 19 | 33 | 76 |

| | 10° | | | 11° | | | 12° | | | 13° | | | 14° | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LHA | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | LHA |
| | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | |
| 70 | 22 13 | +30 | 92 | 22 43 | +29 | 91 | 23 12 | +28 | 90 | 23 40 | +29 | 89 | 24 09 | +28 | 88 | 290 |
| 71 | 21 22 | 29 | 91 | 21 51 | 29 | 90 | 22 20 | 29 | 89 | 22 49 | 28 | 88 | 23 17 | 29 | 87 | 289 |
| 72 | 20 30 | 30 | 91 | 21 00 | 29 | 90 | 21 29 | 29 | 89 | 21 58 | 28 | 88 | 22 26 | 28 | 87 | 288 |
| 73 | 19 39 | 29 | 90 | 20 08 | 29 | 89 | 20 37 | 29 | 88 | 21 06 | 29 | 87 | 21 35 | 28 | 86 | 287 |
| 74 | 18 47 | 30 | 90 | 19 17 | 29 | 89 | 19 46 | 29 | 88 | 20 15 | 28 | 87 | 20 43 | 29 | 86 | 286 |
| 75 | 17 56 | +29 | 89 | 18 25 | +30 | 88 | 18 55 | +29 | 87 | 19 24 | +28 | 86 | 19 52 | +28 | 85 | 285 |
| 76 | 17 05 | 29 | 88 | 17 34 | 29 | 88 | 18 03 | 29 | 87 | 18 32 | 29 | 86 | 19 01 | 28 | 85 | 284 |
| 77 | 16 13 | 30 | 88 | 16 43 | 29 | 87 | 17 12 | 29 | 86 | 17 41 | 29 | 85 | 18 10 | 28 | 84 | 283 |
| 78 | 15 22 | 29 | 87 | 15 51 | 30 | 87 | 16 21 | 29 | 86 | 16 50 | 29 | 85 | 17 19 | 28 | 84 | 282 |
| 79 | 14 30 | 30 | 87 | 15 00 | 29 | 86 | 15 29 | 30 | 85 | 15 59 | 28 | 84 | 16 27 | 29 | 83 | 281 |
| 80 | 13 39 | +30 | 86 | 14 09 | +29 | 86 | 14 38 | +29 | 85 | 15 07 | +29 | 84 | 15 36 | +29 | 83 | 280 |
| 81 | 12 48 | 30 | 86 | 13 18 | 29 | 85 | 13 47 | 29 | 84 | 14 16 | 29 | 83 | 14 45 | 29 | 82 | 279 |
| 82 | 11 57 | 29 | 85 | 12 26 | 30 | 85 | 12 56 | 29 | 84 | 13 25 | 29 | 83 | 13 54 | 29 | 82 | 278 |
| 83 | 11 05 | 30 | 85 | 11 35 | 30 | 84 | 12 05 | 29 | 83 | 12 34 | 30 | 82 | 13 04 | 29 | 81 | 277 |
| 84 | 10 14 | 30 | 84 | 10 44 | 30 | 84 | 11 14 | 29 | 83 | 11 43 | 30 | 82 | 12 13 | 29 | 81 | 276 |
| 85 | 09 23 | +30 | 84 | 09 53 | +30 | 83 | 10 23 | +29 | 82 | 10 52 | +30 | 81 | 11 22 | +29 | 80 | 275 |
| 86 | 08 32 | 30 | 83 | 09 02 | 30 | 83 | 09 32 | 30 | 82 | 10 02 | 29 | 81 | 10 31 | 30 | 80 | 274 |
| 87 | 07 41 | 30 | 83 | 08 11 | 30 | 82 | 08 41 | 30 | 81 | 09 11 | 30 | 80 | 09 41 | 29 | 79 | 273 |
| 88 | 06 50 | 30 | 82 | 07 20 | 30 | 82 | 07 50 | 30 | 81 | 08 20 | 30 | 80 | 08 50 | 30 | 79 | 272 |
| 89 | 05 59 | 30 | 82 | 06 29 | 31 | 81 | 07 00 | 30 | 80 | 07 30 | 30 | 79 | 08 00 | 30 | 78 | 271 |
| 90 | 05 08 | +30 | 81 | 05 38 | +31 | 81 | 06 09 | +30 | 80 | 06 39 | +31 | 79 | 07 10 | +30 | 78 | 270 |
| 91 | 04 17 | 31 | 81 | 04 48 | 30 | 80 | 05 18 | 31 | 79 | 05 49 | 30 | 78 | 06 19 | 31 | 77 | 269 |
| 92 | 03 26 | 31 | 80 | 03 57 | 31 | 80 | 04 28 | 30 | 79 | 04 58 | 31 | 78 | 05 29 | 31 | 77 | 268 |
| 93 | 02 36 | 31 | 80 | 03 07 | 30 | 79 | 03 37 | 31 | 78 | 04 08 | 31 | 77 | 04 39 | 31 | 76 | 267 |
| 94 | 01 45 | 31 | 79 | 02 16 | 31 | 79 | 02 47 | 31 | 78 | 03 18 | 31 | 77 | 03 49 | 31 | 76 | 266 |
| 95 | 00 55 | +31 | 79 | 01 26 | +31 | 78 | 01 57 | +31 | 77 | 02 28 | +31 | 76 | 02 59 | +31 | 75 | 265 |
| 96 | 00 04 | 31 | 78 | 00 35 | 32 | 78 | 01 07 | 31 | 77 | 01 38 | 32 | 76 | 02 10 | 31 | 75 | 264 |
| 97 | −0 46 | 31 | 78 | −0 15 | 32 | 77 | 00 17 | 31 | 76 | 00 48 | 32 | 75 | 01 20 | 31 | 74 | 263 |
| 98 | −1 36 | 31 | 77 | −1 05 | 32 | 76 | −0 33 | 32 | 76 | −0 01 | 31 | 75 | 00 30 | 32 | 74 | 262 |
| 99 | −2 27 | 32 | 77 | −1 55 | 32 | 76 | −1 23 | 32 | 75 | −0 51 | 32 | 74 | −0 19 | 32 | 73 | 261 |
| 100 | −3 17 | +32 | 76 | −2 45 | +33 | 75 | −2 12 | +32 | 75 | −1 40 | +32 | 74 | −1 08 | +32 | 73 | 260 |
| 101 | −4 06 | 32 | 76 | −3 34 | 32 | 75 | −3 02 | 32 | 74 | −2 30 | 33 | 73 | −1 57 | 32 | 72 | 259 |
| 102 | −4 56 | 32 | 75 | −4 24 | 33 | 74 | −3 51 | 32 | 74 | −3 19 | 33 | 73 | −2 46 | 32 | 72 | 258 |
| 103 | −5 46 | 33 | 75 | −5 13 | 32 | 74 | −4 41 | 33 | 73 | −4 08 | 33 | 72 | −3 35 | 33 | 71 | 257 |
| 104 | −6 36 | 33 | 74 | −6 03 | 33 | 73 | −5 30 | 33 | 72 | −4 57 | 33 | 72 | −4 24 | 33 | 71 | 256 |
| 105 | | | | | | | −6 19 | +34 | 72 | −5 45 | +33 | 71 | −5 12 | +33 | 70 | 255 |
| 106 | | | | | | | | | | −6 34 | 34 | 70 | −6 00 | 33 | 70 | 254 |

| | 0° | | | 1° | | | 2° | | | 3° | | | 4° | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LHA | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z |
| 97 | −6 00 | 31 | 86 | −6 31 | 31 | 87 | | | | | | | | | |
| 96 | −5 08 | 31 | 87 | −5 39 | 31 | 88 | −6 10 | 31 | 89 | −6 41 | 31 | 90 | | | |
| 95 | −4 17 | −31 | 87 | −4 48 | −31 | 88 | −5 19 | −31 | 89 | −5 50 | −31 | 90 | −6 21 | −30 | 91 |
| 94 | −3 26 | 31 | 88 | −3 57 | 30 | 89 | −4 27 | 31 | 90 | −4 58 | 31 | 91 | −5 29 | 31 | 91 |
| 93 | −2 34 | 31 | 88 | −3 05 | 31 | 89 | −3 36 | 31 | 90 | −4 07 | 31 | 91 | −4 38 | 30 | 92 |
| 92 | −1 43 | 31 | 89 | −2 14 | 31 | 90 | −2 45 | 30 | 91 | −3 15 | 31 | 92 | −3 46 | 31 | 92 |
| 91 | −0 51 | 31 | 89 | −1 22 | 31 | 90 | −1 53 | 31 | 91 | −2 24 | 31 | 92 | −2 55 | 31 | 93 |
| 90 | 00 00 | −31 | 90 | −0 31 | −31 | 91 | −1 02 | −31 | 92 | −1 33 | −31 | 93 | −2 04 | −30 | 93 |
| 89 | 00 51 | 30 | 91 | 00 21 | 31 | 91 | −0 10 | 31 | 92 | −0 41 | 31 | 93 | −1 12 | 31 | 94 |
| 88 | 01 43 | 31 | 91 | 01 12 | 31 | 92 | 00 41 | 31 | 93 | 00 10 | 31 | 94 | −0 21 | 31 | 94 |
| 87 | 02 34 | 31 | 92 | 02 03 | 31 | 92 | 01 32 | 31 | 93 | 01 01 | 31 | 94 | 00 30 | 31 | 95 |
| 86 | 03 26 | 31 | 92 | 02 55 | 31 | 93 | 02 24 | 31 | 94 | 01 53 | 31 | 95 | 01 22 | 32 | 95 |
| 85 | 04 17 | −31 | 93 | 03 46 | −31 | 93 | 03 15 | −31 | 94 | 02 44 | −31 | 95 | 02 13 | −31 | 96 |
| 84 | 05 08 | 31 | 93 | 04 37 | 31 | 94 | 04 06 | 31 | 95 | 03 35 | 31 | 96 | 03 04 | 31 | 97 |
| 83 | 06 00 | 31 | 94 | 05 29 | 32 | 95 | 04 57 | 31 | 95 | 04 26 | 31 | 96 | 03 55 | 31 | 97 |
| 82 | 06 51 | 31 | 94 | 06 20 | 31 | 95 | 05 49 | 32 | 96 | 05 17 | 31 | 97 | 04 46 | 32 | 98 |
| 81 | 07 42 | 31 | 95 | 07 11 | 31 | 96 | 06 40 | 32 | 96 | 06 08 | 31 | 97 | 05 37 | 32 | 98 |
| 80 | 08 34 | −32 | 95 | 08 02 | −31 | 96 | 07 31 | −32 | 97 | 06 59 | −31 | 98 | 06 28 | −32 | 99 |
| 79 | 09 25 | 32 | 96 | 08 53 | 31 | 97 | 08 22 | 32 | 97 | 07 50 | 31 | 98 | 07 19 | 32 | 99 |
| 78 | 10 16 | 31 | 96 | 09 45 | 32 | 97 | 09 13 | 32 | 98 | 08 41 | 32 | 99 | 08 09 | [illegible] | 100 |
| 77 | 11 07 | 31 | 97 | 10 36 | 32 | 98 | 10 04 | 32 | 99 | 09 32 | 32 | 99 | 09 00 | 32 | 100 |
| 76 | 11 58 | 32 | 97 | 11 26 | 31 | 98 | 10 55 | 32 | 99 | 10 23 | 32 | 100 | 09 51 | 33 | 101 |
| 75 | 12 49 | −32 | 98 | 12 17 | −32 | 99 | 11 45 | −32 | 100 | 11 13 | −32 | 101 | 10 41 | −32 | 101 |
| 74 | 13 40 | 32 | 98 | 13 08 | 32 | 99 | 12 36 | 32 | 100 | 12 04 | 33 | 101 | 11 31 | 32 | 102 |
| 73 | 14 31 | 32 | 99 | 13 59 | 32 | 100 | 13 27 | 33 | 101 | 12 54 | 32 | 102 | 12 22 | 33 | 102 |
| 72 | 15 22 | 32 | 100 | 14 49 | 32 | 100 | 14 17 | 32 | 101 | 13 45 | 33 | 102 | 13 12 | 33 | 103 |
| 71 | 16 12 | 32 | 100 | 15 40 | 32 | 101 | 15 08 | 33 | 102 | 14 35 | 33 | 103 | 14 02 | 33 | 104 |
| 70 | 17 03 | −32 | 101 | 16 30 | −32 | 102 | 15 58 | −33 | 102 | 15 25 | −33 | 103 | 14 52 | −33 | 104 |

| | 5° | | | 6° | | | 7° | | | 8° | | | 9° | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LHA | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z |
| 94 | −6 00 | 30 | 92 | −6 30 | 31 | 93 | | | | | | | | | |
| 93 | −5 08 | 31 | 93 | −5 39 | 31 | 94 | −6 10 | 30 | 94 | −6 40 | 30 | 95 | | | |
| 92 | −4 17 | 31 | 93 | −4 48 | 30 | 94 | −5 18 | 31 | 95 | −5 49 | 30 | 96 | −6 19 | 31 | 97 |
| 91 | −3 26 | 30 | 94 | −3 56 | 31 | 95 | −4 27 | 31 | 95 | −4 58 | 30 | 96 | −5 28 | 31 | 97 |
| 90 | −2 34 | −31 | 94 | −3 05 | −31 | 95 | −3 36 | −31 | 96 | −4 07 | −30 | 97 | −4 37 | −31 | 98 |
| 89 | −1 43 | 31 | 95 | −2 14 | 31 | 96 | −2 45 | 31 | 97 | −3 16 | 30 | 97 | −3 46 | 31 | 98 |
| 88 | −0 52 | 31 | 95 | −1 23 | 31 | 96 | −1 54 | 31 | 97 | −2 25 | 30 | 98 | −2 55 | 31 | 99 |
| 87 | −0 01 | 31 | 96 | −0 32 | 31 | 97 | −1 03 | 31 | 98 | −1 34 | 31 | 98 | −2 05 | 31 | 99 |
| 86 | 00 50 | 31 | 96 | 00 19 | 31 | 97 | −0 12 | 31 | 98 | −0 43 | 31 | 99 | −1 14 | 31 | 100 |
| 85 | 01 42 | −32 | 97 | 01 10 | −31 | 98 | 00 39 | −31 | 99 | 00 08 | −31 | 99 | −0 23 | −32 | 100 |
| 84 | 02 33 | 32 | 97 | 02 01 | 31 | 98 | 01 30 | 31 | 99 | 00 59 | 32 | 100 | 00 27 | 31 | 101 |
| 83 | 03 24 | 32 | 98 | 02 52 | 31 | 99 | 02 21 | 32 | 100 | 01 49 | 31 | 100 | 01 18 | 32 | 101 |
| 82 | 04 14 | 31 | 98 | 03 43 | 32 | 99 | 03 11 | 31 | 100 | 02 40 | 32 | 101 | 02 08 | 32 | 102 |
| 81 | 05 05 | 31 | 99 | 04 34 | 32 | 100 | 04 02 | 32 | 101 | 03 30 | 32 | 101 | 02 58 | 31 | 102 |
| 80 | 05 56 | −32 | 100 | 05 24 | −32 | 100 | 04 52 | −31 | 101 | 04 21 | −32 | 102 | 03 49 | −32 | 103 |
| 79 | 06 47 | 32 | 100 | 06 15 | 32 | 101 | 05 43 | 32 | 102 | 05 11 | 32 | 103 | 04 39 | 33 | 103 |
| 78 | 07 37 | 32 | 101 | 07 05 | 32 | 101 | 06 33 | 32 | 102 | 06 01 | 32 | 103 | 05 29 | 33 | 104 |
| 77 | 08 28 | 32 | 101 | 07 56 | 33 | 102 | 07 23 | 32 | 103 | 06 51 | 32 | 104 | 06 19 | 33 | 105 |
| 76 | 09 18 | 32 | 102 | 08 46 | 32 | 103 | 08 14 | 33 | 103 | 07 41 | 33 | 104 | 07 08 | 32 | 105 |
| 75 | 10 09 | −33 | 102 | 09 36 | −32 | 103 | 09 04 | −33 | 104 | 08 31 | −33 | 105 | 07 58 | −33 | 106 |
| 74 | 10 59 | 33 | 103 | 10 26 | 33 | 104 | 09 53 | 33 | 104 | 09 20 | 33 | 105 | 08 47 | 33 | 106 |
| 73 | 11 49 | 33 | 103 | 11 16 | 33 | 104 | 10 43 | 33 | 105 | 10 10 | 33 | 106 | 09 37 | 34 | 107 |
| 72 | 12 39 | 33 | 104 | 12 06 | 33 | 105 | 11 33 | 34 | 106 | 10 59 | 33 | 106 | 10 26 | 34 | 107 |
| 71 | 13 29 | 33 | 104 | 12 56 | 34 | 105 | 12 22 | 33 | 106 | 11 49 | 34 | 107 | 11 15 | 34 | 108 |
| 70 | 14 19 | −34 | 105 | 13 45 | −33 | 106 | 13 12 | −34 | 107 | 12 38 | −34 | 108 | 12 04 | −34 | 108 |

| | 10° | | | 11° | | | 12° | | | 13° | | | 14° | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LHA | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | LHA |
| 97 | | | | | | | | | | | | | | | | 263 |
| 96 | | | | | | | | | | | | | | | | 264 |
| 95 | | | | | | | | | | | | | | | | 265 |
| 94 | | | | | | | | | | | | | | | | 266 |
| 93 | | | | | | | | | | | | | | | | 267 |
| 92 | | | | | | | | | | | | | | | | 268 |
| 91 | −5 59 | 30 | 98 | −6 29 | 31 | 99 | | | | | | | | | | 269 |
| 90 | −5 08 | −30 | 99 | −5 38 | −31 | 99 | −6 09 | −30 | 100 | −6 39 | −31 | 101 | | | | 270 |
| 89 | −4 17 | 31 | 99 | −4 48 | 30 | 100 | −5 18 | 31 | 101 | −5 49 | 30 | 102 | −6 19 | 31 | 103 | 271 |
| 88 | −3 26 | 31 | 100 | −3 57 | 31 | 100 | −4 28 | 30 | 101 | −4 58 | 31 | 102 | −5 29 | 31 | 103 | 272 |
| 87 | −2 36 | 31 | 100 | −3 07 | 30 | 101 | −3 37 | 31 | 102 | −4 08 | 31 | 103 | −4 39 | 31 | 104 | 273 |
| 86 | −1 45 | 31 | 101 | −2 16 | 31 | 101 | −2 47 | 31 | 102 | −3 18 | 31 | 103 | −3 49 | 31 | 104 | 274 |
| 85 | −0 55 | −31 | 101 | −1 26 | −31 | 102 | −1 57 | −31 | 103 | −2 28 | −31 | 104 | −2 59 | −31 | 105 | 275 |
| 84 | −0 04 | 31 | 102 | −0 35 | 32 | 102 | −1 07 | 31 | 103 | −1 38 | 32 | 104 | −2 10 | 31 | 105 | 276 |
| 83 | 00 46 | 31 | 102 | 00 15 | 32 | 103 | −0 17 | 31 | 104 | −0 48 | 32 | 105 | −1 20 | 31 | 106 | 277 |
| 82 | 01 36 | 31 | 103 | 01 05 | 32 | 104 | 00 33 | 32 | 104 | 00 01 | 31 | 105 | −0 30 | 32 | 106 | 278 |
| 81 | 02 27 | 32 | 103 | 01 55 | 32 | 104 | 01 23 | 32 | 105 | 00 51 | 32 | 106 | 00 19 | 32 | 107 | 279 |
| 80 | 03 17 | −32 | 104 | 02 45 | −33 | 105 | 02 12 | −32 | 105 | 01 40 | −32 | 106 | 01 08 | −32 | 107 | 280 |
| 79 | 04 06 | 32 | 104 | 03 34 | 32 | 105 | 03 02 | 32 | 106 | 02 30 | 33 | 107 | 01 57 | 32 | 108 | 281 |
| 78 | 04 56 | 32 | 105 | 04 24 | 33 | 106 | 03 51 | 32 | 106 | 03 19 | 33 | 107 | 02 46 | 32 | 108 | 282 |
| 77 | 05 46 | 33 | 105 | 05 13 | 32 | 106 | 04 41 | 33 | 107 | 04 08 | 33 | 108 | 03 35 | 33 | 109 | 283 |
| 76 | 06 36 | 33 | 106 | 06 03 | 33 | 107 | 05 30 | 33 | 108 | 04 57 | 33 | 108 | 04 24 | 33 | 109 | 284 |
| 75 | 07 25 | −33 | 106 | 06 52 | −33 | 107 | 06 19 | −34 | 108 | 05 45 | −33 | 109 | 05 12 | −33 | 110 | 285 |
| 74 | 08 14 | 33 | 107 | 07 41 | 33 | 108 | 07 08 | 34 | 109 | 06 34 | 34 | 110 | 06 00 | 33 | 110 | 286 |
| 73 | 09 03 | 33 | 108 | 08 30 | 34 | 108 | 07 56 | 34 | 109 | 07 22 | 33 | 110 | 06 49 | 34 | 111 | 287 |
| 72 | 09 52 | 33 | 108 | 09 19 | 34 | 109 | 08 45 | 34 | 110 | 08 11 | 34 | 111 | 07 37 | 35 | 111 | 288 |
| 71 | 10 41 | 34 | 109 | 10 07 | 34 | 110 | 09 33 | 34 | 110 | 08 59 | 35 | 111 | 08 24 | 34 | 112 | 289 |
| 70 | 11 30 | −35 | 109 | 10 55 | −34 | 110 | 10 21 | −34 | 111 | 09 47 | −35 | 112 | 09 12 | −35 | 113 | 290 |

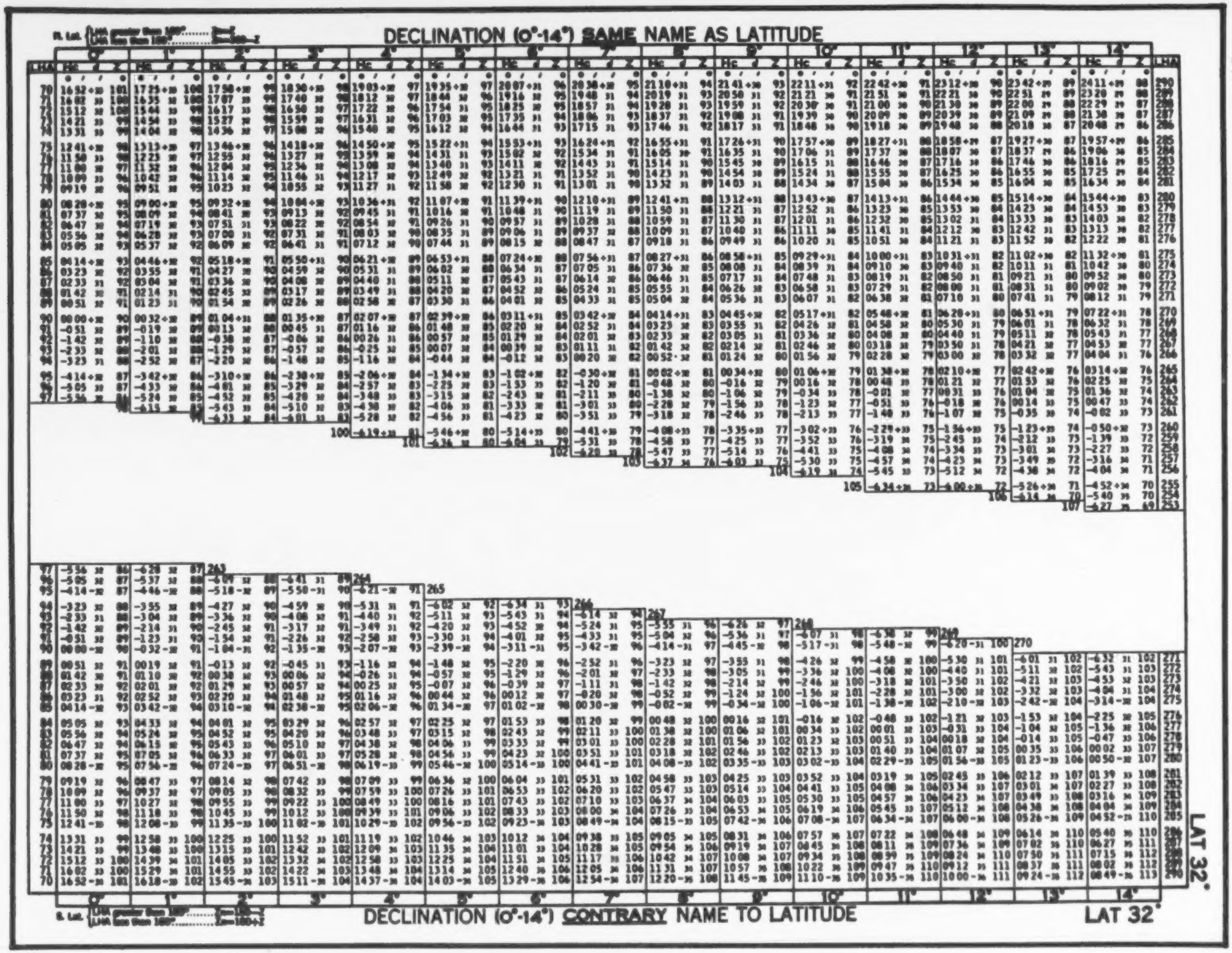
S. Lat. {LHA greater than 180° .......... Zn=180−Z
{LHA less than 180° .......... Zn=180+Z

## DECLINATION (0°-14°) CONTRARY NAME TO LATITUDE

LAT 31°

LAT 31°

FIGURE 149.—Declination (0° - 14°) LAT 31°.



# DECLINATION (0°-14°) SAME NAME AS LATITUDE

DECLINATION (0°-14°) CONTRARY NAME TO LATITUDE

LAT 32°

355

356

FIGURE 150.—Declination (0° - 14°) LAT 32°.

N. Lat. {LHA greater than 180°.......Zn=Z
{LHA less than 180°..........Zn=360−Z

## DECLINATION (15°-29°) CONTRARY NAME TO LATITUDE

| LHA | 15° | | | 16° | | | 17° | | | 18° | | | 19° | | | 20° | | | 21° | | | 22° | | | 23° | | | 24° | | | 25° | | | 26° | | | 27° | | | 28° | | | 29° | | | LHA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | |
| | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | |
| 69 | 09 00 | 36 | 114 | 08 24 | 36 | 115 | 07 48 | 36 | 116 | 07 12 | 36 | 117 | 06 36 | 37 | 117 | 05 59 | 36 | 118 | 05 23 | 36 | 119 | 04 47 | 37 | 120 | 04 10 | 36 | 121 | 03 34 | 37 | 121 | 02 57 | 37 | 122 | 02 20 | 36 | 123 | 01 44 | 37 | 124 | 01 07 | 36 | 124 | 00 31 | 37 | 125 | 291 |
| 68 | 09 46 | 36 | 115 | 09 10 | 36 | 116 | 08 34 | 37 | 116 | 07 57 | 36 | 117 | 07 21 | 37 | 118 | 06 44 | 37 | 119 | 06 07 | 36 | 120 | 05 31 | 37 | 120 | 04 54 | 37 | 121 | 04 17 | 37 | 122 | 03 40 | 37 | 123 | 03 03 | 37 | 123 | 02 26 | 37 | 124 | 01 49 | 37 | 125 | 01 12 | 37 | 126 | 292 |
| 67 | 10 32 | 36 | 115 | 09 56 | 37 | 116 | 09 19 | 37 | 117 | 08 42 | 36 | 118 | 08 06 | 37 | 119 | 07 29 | 37 | 119 | 06 52 | 37 | 120 | 06 15 | 38 | 121 | 05 37 | 37 | 122 | 05 00 | 37 | 122 | 04 23 | 38 | 123 | 03 45 | 37 | 124 | 03 08 | 37 | 125 | 02 31 | 38 | 126 | 01 53 | 37 | 126 | 293 |
| 66 | 11 18 | 37 | 116 | 10 41 | 36 | 117 | 10 05 | 38 | 118 | 09 27 | 37 | 118 | 08 50 | 37 | 119 | 08 13 | 37 | 120 | 07 36 | 38 | 121 | 06 58 | 37 | 121 | 06 21 | 38 | 122 | 05 43 | 38 | 123 | 05 05 | 38 | 124 | 04 27 | 37 | 125 | 03 50 | 38 | 125 | 03 12 | 38 | 126 | 02 34 | 38 | 127 | 294 |
| 65 | 12 04 | −37 | 117 | 11 27 | −37 | 117 | 10 50 | −38 | 118 | 10 12 | −37 | 119 | 09 35 | −38 | 120 | 08 57 | −38 | 120 | 08 19 | −38 | 121 | 07 41 | −38 | 122 | 07 03 | −38 | 123 | 06 25 | −38 | 124 | 05 47 | −38 | 124 | 05 09 | −38 | 125 | 04 31 | −38 | 126 | 03 53 | −38 | 127 | 03 15 | −39 | 127 | 295 |
| 64 | 12 49 | 37 | 117 | 12 12 | 38 | 118 | 11 34 | 37 | 119 | 10 57 | 38 | 120 | 10 19 | 38 | 120 | 09 41 | 38 | 121 | 09 03 | 39 | 122 | 08 24 | 38 | 123 | 07 46 | 38 | 123 | 07 08 | 39 | 124 | 06 29 | 38 | 125 | 05 51 | 39 | 126 | 05 12 | 39 | 127 | 04 33 | 38 | 127 | 03 55 | 39 | 128 | 296 |
| 63 | 13 35 | 38 | 118 | 12 57 | 38 | 119 | 12 19 | 38 | 119 | 11 41 | 39 | 120 | 11 02 | 38 | 121 | 10 24 | 38 | 122 | 09 46 | 39 | 122 | 09 07 | 39 | 123 | 08 28 | 38 | 124 | 07 50 | 39 | 125 | 07 11 | 39 | 126 | 06 32 | 39 | 126 | 05 53 | 39 | 127 | 05 14 | 39 | 128 | 04 35 | 40 | 129 | 297 |
| 62 | 14 20 | 39 | 118 | 13 41 | 38 | 119 | 13 03 | 38 | 120 | 12 25 | 39 | 121 | 11 46 | 39 | 122 | 11 07 | 39 | 122 | 10 28 | 38 | 123 | 09 50 | 40 | 124 | 09 10 | 39 | 125 | 08 31 | 39 | 125 | 07 52 | 39 | 126 | 07 13 | 40 | 127 | 06 33 | 39 | 128 | 05 54 | 40 | 128 | 05 14 | 39 | 129 | 298 |
| 61 | 15 04 | 38 | 119 | 14 26 | 39 | 120 | 13 47 | 39 | 121 | 13 08 | 39 | 121 | 12 29 | 39 | 122 | 11 50 | 39 | 123 | 11 11 | 39 | 124 | 10 32 | 40 | 124 | 09 52 | 39 | 125 | 09 13 | 40 | 126 | 08 33 | 40 | 127 | 07 53 | 39 | 128 | 07 14 | 40 | 128 | 06 34 | 40 | 129 | 05 54 | 40 | 130 | 299 |
| 60 | 15 49 | −39 | 120 | 15 10 | −39 | 120 | 14 31 | −39 | 121 | 13 52 | −40 | 122 | 13 12 | −39 | 123 | 12 33 | −40 | 124 | 11 53 | −40 | 124 | 11 13 | −39 | 125 | 10 34 | −40 | 126 | 09 54 | −40 | 127 | 09 14 | −40 | 127 | 08 34 | −41 | 128 | 07 53 | −40 | 129 | 07 13 | −40 | 130 | 06 33 | −41 | 130 | 300 |
| 59 | 16 33 | 40 | 120 | 15 53 | 39 | 121 | 15 14 | 39 | 122 | 14 35 | 40 | 123 | 13 55 | 40 | 123 | 13 15 | 40 | 124 | 12 35 | 40 | 125 | 11 55 | 40 | 126 | 11 15 | 41 | 126 | 10 34 | 40 | 127 | 09 54 | 41 | 128 | 09 13 | 40 | 129 | 08 33 | 41 | 129 | 07 52 | 41 | 130 | 07 11 | 41 | 131 | 301 |
| 58 | 17 16 | 39 | 121 | 16 37 | 40 | 122 | 15 57 | 40 | 123 | 15 17 | 40 | 123 | 14 37 | 40 | 124 | 13 57 | 40 | 125 | 13 17 | 41 | 126 | 12 36 | 41 | 126 | 11 55 | 40 | 127 | 11 15 | 41 | 128 | 10 34 | 41 | 129 | 09 53 | 41 | 129 | 09 12 | 41 | 130 | 08 31 | 41 | 131 | 07 50 | 42 | 132 | 302 |
| 57 | 18 00 | 40 | 122 | 17 20 | 40 | 122 | 16 40 | 40 | 123 | 16 00 | 41 | 124 | 15 19 | 40 | 125 | 14 39 | 41 | 126 | 13 58 | 41 | 126 | 13 17 | 41 | 127 | 12 36 | 41 | 128 | 11 55 | 41 | 129 | 11 14 | 42 | 129 | 10 32 | 41 | 130 | 09 51 | 42 | 131 | 09 09 | 42 | 131 | 08 27 | 41 | 132 | 303 |
| 56 | 18 43 | 40 | 122 | 18 03 | 41 | 123 | 17 22 | 40 | 124 | 16 42 | 41 | 125 | 16 01 | 41 | 125 | 15 20 | 41 | 126 | 14 39 | 42 | 127 | 13 57 | 41 | 128 | 13 16 | 42 | 128 | 12 34 | 41 | 129 | 11 53 | 42 | 130 | 11 11 | 42 | 131 | 10 29 | 42 | 131 | 09 47 | 42 | 132 | 09 05 | 42 | 133 | 304 |
| 55 | 19 26 | −41 | 123 | 18 45 | −41 | 124 | 18 04 | −41 | 125 | 17 23 | −41 | 125 | 16 42 | −41 | 126 | 16 01 | −42 | 127 | 15 19 | −41 | 128 | 14 38 | −42 | 128 | 13 56 | −42 | 129 | 13 14 | −42 | 130 | 12 32 | −43 | 131 | 11 49 | −42 | 131 | 11 07 | −42 | 132 | 10 25 | −43 | 133 | 09 42 | −42 | 133 | 305 |
| 54 | 20 09 | 42 | 124 | 19 27 | 41 | 124 | 18 46 | 41 | 125 | 18 05 | 42 | 126 | 17 23 | 42 | 127 | 16 41 | 42 | 128 | 15 59 | 42 | 128 | 15 17 | 42 | 129 | 14 35 | 42 | 130 | 13 53 | 43 | 130 | 13 10 | 42 | 131 | 12 28 | 43 | 132 | 11 45 | 43 | 133 | 11 02 | 43 | 133 | 10 19 | 43 | 134 | 306 |
| 53 | 20 51 | 42 | 124 | 20 09 | 41 | 125 | 19 28 | 42 | 126 | 18 46 | 42 | 127 | 18 04 | 42 | 127 | 17 22 | 43 | 128 | 16 39 | 42 | 129 | 15 57 | 43 | 130 | 15 14 | 43 | 130 | 14 31 | 43 | 131 | 13 48 | 43 | 132 | 13 05 | 43 | 133 | 12 22 | 43 | 133 | 11 39 | 44 | 134 | 10 55 | 43 | 135 | 307 |
| 52 | 21 33 | 42 | 125 | 20 51 | 42 | 126 | 20 09 | 43 | 127 | 19 26 | 42 | 127 | 18 44 | 43 | 128 | 18 01 | 42 | 129 | 17 19 | 43 | 130 | 16 36 | 43 | 130 | 15 53 | 44 | 131 | 15 09 | 43 | 132 | 14 26 | 43 | 133 | 13 43 | 44 | 133 | 12 59 | 44 | 134 | 12 15 | 44 | 135 | 11 31 | 44 | 135 | 308 |
| 51 | 22 14 | 42 | 126 | 21 32 | 43 | 127 | 20 49 | 42 | 127 | 20 07 | 43 | 128 | 19 24 | 43 | 129 | 18 41 | 43 | 130 | 17 58 | 44 | 130 | 17 14 | 43 | 131 | 16 31 | 44 | 132 | 15 47 | 44 | 133 | 15 03 | 44 | 133 | 14 19 | 44 | 134 | 13 35 | 44 | 135 | 12 51 | 44 | 135 | 12 07 | 44 | 136 | 309 |
| 50 | 22 55 | −43 | 127 | 22 12 | −42 | 127 | 21 30 | −44 | 128 | 20 46 | −43 | 129 | 20 03 | −43 | 130 | 19 20 | −44 | 130 | 18 36 | −44 | 131 | 17 52 | −43 | 132 | 17 09 | −45 | 132 | 16 24 | −44 | 133 | 15 40 | −44 | 134 | 14 56 | −45 | 135 | 14 11 | −44 | 135 | 13 27 | −45 | 136 | 12 42 | −45 | 137 | 310 |
| 49 | 23 36 | 43 | 127 | 22 53 | 44 | 128 | 22 09 | 43 | 129 | 21 26 | 44 | 130 | 20 42 | 44 | 130 | 19 58 | 44 | 131 | 19 14 | 44 | 132 | 18 30 | 44 | 132 | 17 46 | 45 | 133 | 17 01 | 44 | 134 | 16 17 | 45 | 135 | 15 32 | 45 | 135 | 14 47 | 45 | 136 | 14 02 | 45 | 137 | 13 17 | 45 | 137 | 311 |
| 48 | 24 16 | 43 | 128 | 23 33 | 44 | 129 | 22 49 | 44 | 130 | 22 05 | 44 | 130 | 21 21 | 44 | 131 | 20 37 | 45 | 132 | 19 52 | 44 | 133 | 19 08 | 45 | 133 | 18 23 | 45 | 134 | 17 38 | 45 | 135 | 16 53 | 45 | 135 | 16 08 | 46 | 136 | 15 22 | 45 | 137 | 14 37 | 46 | 137 | 13 51 | 46 | 138 | 312 |
| 47 | 24 56 | 44 | 129 | 24 12 | 44 | 130 | 23 28 | 44 | 130 | 22 44 | 45 | 131 | 21 59 | 45 | 132 | 21 14 | 45 | 133 | 20 29 | 45 | 133 | 19 44 | 45 | 134 | 18 59 | 45 | 135 | 18 14 | 46 | 135 | 17 28 | 45 | 136 | 16 43 | 46 | 137 | 15 57 | 46 | 137 | 15 11 | 46 | 138 | 14 25 | 46 | 139 | 313 |
| 46 | 25 35 | 44 | 130 | 24 51 | 45 | 130 | 24 06 | 44 | 131 | 23 22 | 45 | 132 | 22 37 | 45 | 133 | 21 52 | 46 | 133 | 21 06 | 45 | 134 | 20 21 | 46 | 135 | 19 35 | 46 | 135 | 18 49 | 46 | 136 | 18 03 | 46 | 137 | 17 17 | 46 | 137 | 16 31 | 46 | 138 | 15 45 | 47 | 139 | 14 58 | 46 | 139 | 314 |
| 45 | 26 14 | −45 | 130 | 25 29 | −44 | 131 | 24 45 | −46 | 132 | 23 59 | −45 | 133 | 23 14 | −46 | 133 | 22 28 | −45 | 134 | 21 43 | −46 | 135 | 20 57 | −46 | 135 | 20 11 | −47 | 136 | 19 24 | −46 | 137 | 18 38 | −46 | 137 | 17 52 | −47 | 138 | 17 05 | −47 | 139 | 16 18 | −47 | 139 | 15 31 | −47 | 140 | 315 |
| 44 | 26 53 | 45 | 131 | 26 08 | 46 | 132 | 25 22 | 45 | 133 | 24 37 | 46 | 133 | 23 51 | 46 | 134 | 23 05 | 46 | 135 | 22 19 | 47 | 136 | 21 32 | 46 | 136 | 20 46 | 47 | 137 | 19 59 | 47 | 138 | 19 12 | 47 | 138 | 18 25 | 47 | 139 | 17 38 | 47 | 140 | 16 51 | 47 | 140 | 16 04 | 48 | 141 | 316 |
| 43 | 27 31 | 46 | 132 | 26 45 | 46 | 133 | 25 59 | 46 | 134 | 25 13 | 46 | 134 | 24 27 | 46 | 135 | 23 41 | 47 | 136 | 22 54 | 47 | 136 | 22 07 | 47 | 137 | 21 20 | 47 | 138 | 20 33 | 47 | 138 | 19 46 | 47 | 139 | 18 59 | 48 | 140 | 18 11 | 48 | 140 | 17 23 | 47 | 141 | 16 36 | 48 | 142 | 317 |
| 42 | 28 08 | 46 | 133 | 27 22 | 46 | 134 | 26 36 | 46 | 134 | 25 50 | 47 | 135 | 25 03 | 47 | 136 | 24 16 | 47 | 136 | 23 29 | 47 | 137 | 22 42 | 48 | 138 | 21 54 | 47 | 138 | 21 07 | 48 | 139 | 20 19 | 48 | 140 | 19 31 | 48 | 140 | 18 43 | 48 | 141 | 17 55 | 48 | 142 | 17 07 | 48 | 142 | 318 |
| 41 | 28 45 | 46 | 134 | 27 59 | 47 | 134 | 27 12 | 47 | 135 | 26 25 | 47 | 136 | 25 38 | 47 | 137 | 24 51 | 48 | 137 | 24 03 | 47 | 138 | 23 16 | 48 | 139 | 22 28 | 48 | 139 | 21 40 | 48 | 140 | 20 52 | 49 | 141 | 20 03 | 48 | 141 | 19 15 | 48 | 142 | 18 27 | 49 | 142 | 17 38 | 49 | 143 | 319 |
| 40 | 29 22 | −47 | 135 | 28 35 | −47 | 135 | 27 48 | −48 | 136 | 27 00 | −47 | 137 | 26 13 | −48 | 137 | 25 25 | −48 | 138 | 24 37 | −48 | 139 | 23 49 | −48 | 139 | 23 01 | −49 | 140 | 22 12 | −48 | 141 | 21 24 | −49 | 141 | 20 35 | −49 | 142 | 19 46 | −49 | 143 | 18 57 | −49 | 143 | 18 08 | −49 | 144 | 320 |
| 39 | 29 58 | 48 | 135 | 29 10 | 47 | 136 | 28 23 | 48 | 137 | 27 35 | 48 | 138 | 26 47 | 48 | 138 | 25 59 | 48 | 139 | 25 11 | 49 | 140 | 24 22 | 49 | 140 | 23 33 | 49 | 141 | 22 44 | 49 | 141 | 21 55 | 49 | 142 | 21 06 | 49 | 143 | 20 17 | 49 | 143 | 19 28 | 50 | 144 | 18 38 | 50 | 145 | 321 |
| 38 | 30 33 | 48 | 136 | 29 45 | 48 | 137 | 28 57 | 48 | 138 | 28 09 | 48 | 138 | 27 21 | 49 | 139 | 26 32 | 49 | 140 | 25 43 | 49 | 140 | 24 54 | 49 | 141 | 24 05 | 49 | 142 | 23 16 | 50 | 142 | 22 26 | 49 | 143 | 21 37 | 50 | 144 | 20 47 | 50 | 144 | 19 57 | 50 | 145 | 19 07 | 50 | 145 | 322 |
| 37 | 31 08 | 48 | 137 | 30 20 | 49 | 138 | 29 31 | 48 | 139 | 28 43 | 49 | 139 | 27 54 | 49 | 140 | 27 05 | 50 | 141 | 26 15 | 49 | 141 | 25 26 | 50 | 142 | 24 36 | 49 | 143 | 23 47 | 50 | 143 | 22 57 | 50 | 144 | 22 07 | 50 | 144 | 21 17 | 51 | 145 | 20 26 | 50 | 146 | 19 36 | 50 | 146 | 323 |
| 36 | 31 42 | 48 | 138 | 30 54 | 49 | 139 | 30 05 | 49 | 140 | 29 16 | 50 | 140 | 28 26 | 49 | 141 | 27 37 | 50 | 141 | 26 47 | 50 | 142 | 25 57 | 50 | 143 | 25 07 | 50 | 143 | 24 17 | 50 | 144 | 23 27 | 51 | 145 | 22 36 | 50 | 145 | 21 46 | 51 | 146 | 20 55 | 51 | 146 | 20 04 | 51 | 147 | 324 |
| 35 | 32 16 | −49 | 139 | 31 27 | −50 | 140 | 30 37 | −49 | 140 | 29 48 | −50 | 141 | 28 58 | −50 | 142 | 28 08 | −50 | 142 | 27 18 | −50 | 143 | 26 28 | −51 | 144 | 25 37 | −50 | 144 | 24 47 | −51 | 145 | 23 56 | −51 | 145 | 23 05 | −51 | 146 | 22 14 | −51 | 147 | 21 23 | −51 | 147 | 20 32 | −52 | 148 | 325 |
| 34 | 32 49 | 50 | 140 | 31 59 | 49 | 141 | 31 10 | 50 | 141 | 30 20 | 51 | 142 | 29 29 | 50 | 143 | 28 39 | 51 | 143 | 27 48 | 50 | 144 | 26 58 | 51 | 144 | 26 07 | 51 | 145 | 25 16 | 51 | 146 | 24 25 | 52 | 146 | 23 33 | 51 | 147 | 22 42 | 52 | 147 | 21 50 | 51 | 148 | 20 59 | 52 | 148 | 326 |
| 33 | 33 21 | 50 | 141 | 32 31 | 50 | 142 | 31 41 | 50 | 142 | 30 51 | 51 | 143 | 30 00 | 51 | 144 | 29 09 | 51 | 144 | 28 18 | 51 | 145 | 27 27 | 51 | 145 | 26 36 | 52 | 146 | 25 44 | 51 | 147 | 24 53 | 52 | 147 | 24 01 | 52 | 148 | 23 09 | 52 | 148 | 22 17 | 52 | 149 | 21 25 | 52 | 149 | 327 |
| 32 | 33 53 | 50 | 142 | 33 03 | 51 | 143 | 32 12 | 51 | 143 | 31 21 | 51 | 144 | 30 30 | 51 | 144 | 29 39 | 52 | 145 | 28 47 | 51 | 146 | 27 56 | 52 | 146 | 27 04 | 52 | 147 | 26 12 | 52 | 147 | 25 20 | 52 | 148 | 24 28 | 52 | 148 | 23 36 | 53 | 149 | 22 43 | 52 | 150 | 21 51 | 53 | 150 | 328 |
| 31 | 34 24 | 51 | 143 | 33 33 | 51 | 144 | 32 42 | 51 | 144 | 31 51 | 52 | 145 | 30 59 | 52 | 145 | 30 07 | 52 | 146 | 29 15 | 52 | 147 | 28 23 | 52 | 147 | 27 31 | 52 | 148 | 26 39 | 52 | 148 | 25 47 | 53 | 149 | 24 54 | 53 | 149 | 24 01 | 52 | 150 | 23 09 | 53 | 150 | 22 16 | 53 | 151 | 329 |
| 30 | 34 54 | −51 | 144 | 34 03 | −52 | 145 | 33 11 | −51 | 145 | 32 20 | −52 | 146 | 31 28 | −53 | 146 | 30 35 | −52 | 147 | 29 43 | −52 | 148 | 28 51 | −53 | 148 | 27 58 | −53 | 149 | 27 05 | −52 | 149 | 26 13 | −53 | 150 | 25 20 | −53 | 150 | 24 27 | −53 | 151 | 23 34 | −54 | 151 | 22 40 | −53 | 152 | 330 |
| 29 | 35 24 | 52 | 145 | 34 32 | 52 | 146 | 33 40 | 52 | 146 | 32 48 | 53 | 147 | 31 55 | 52 | 147 | 31 03 | 53 | 148 | 30 10 | 53 | 148 | 29 17 | 53 | 149 | 28 24 | 53 | 150 | 27 31 | 53 | 150 | 26 38 | 53 | 151 | 25 45 | 54 | 151 | 24 51 | 53 | 152 | 23 58 | 54 | 152 | 23 04 | 54 | 153 | 331 |
| 28 | 35 53 | 52 | 146 | 35 01 | 53 | 147 | 34 08 | 53 | 147 | 33 15 | 52 | 148 | 32 23 | 53 | 148 | 31 30 | 54 | 149 | 30 36 | 53 | 149 | 29 43 | 53 | 150 | 28 50 | 54 | 150 | 27 56 | 53 | 151 | 27 03 | 54 | 152 | 26 09 | 54 | 152 | 25 15 | 54 | 153 | 24 21 | 54 | 153 | 23 27 | 54 | 153 | 332 |
| 27 | 36 21 | 53 | 147 | 35 28 | 53 | 148 | 34 35 | 53 | 148 | 33 42 | 53 | 149 | 32 49 | 53 | 149 | 31 56 | 54 | 150 | 31 02 | 54 | 150 | 30 08 | 53 | 151 | 29 15 | 54 | 151 | 28 21 | 54 | 152 | 27 27 | 54 | 152 | 26 33 | 55 | 153 | 25 38 | 54 | 153 | 24 44 | 54 | 154 | 23 50 | 55 | 154 | 333 |
| 26 | 36 48 | 53 | 148 | 35 55 | 53 | 149 | 35 02 | 54 | 149 | 34 08 | 53 | 150 | 33 15 | 54 | 150 | 32 21 | 54 | 151 | 31 27 | 54 | 151 | 30 33 | 54 | 152 | 29 39 | 55 | 152 | 28 44 | 54 | 153 | 27 50 | 55 | 153 | 26 55 | 54 | 154 | 26 01 | 55 | 154 | 25 06 | 55 | 155 | 24 11 | 54 | 155 | 334 |
| 25 | 37 15 | −54 | 149 | 36 21 | −54 | 150 | 35 27 | −54 | 150 | 34 33 | −54 | 151 | 33 39 | −54 | 151 | 32 45 | −54 | 152 | 31 51 | −55 | 152 | 30 56 | −54 | 153 | 30 02 | −55 | 153 | 29 07 | −55 | 154 | 28 12 | −55 | 154 | 27 17 | −54 | 155 | 26 23 | −55 | 155 | 25 28 | −56 | 156 | 24 32 | −55 | 156 | 335 |
| 24 | 37 41 | 55 | 150 | 36 46 | 54 | 151 | 35 52 | 54 | 151 | 34 58 | 55 | 152 | 34 03 | 54 | 152 | 33 09 | 55 | 153 | 32 14 | 55 | 153 | 31 19 | 55 | 154 | 30 24 | 55 | 154 | 29 29 | 55 | 155 | 28 34 | 55 | 155 | 27 39 | 55 | 156 | 26 44 | 56 | 156 | 25 48 | 55 | 157 | 24 53 | 56 | 157 | 336 |
| 23 | 38 05 | 54 | 151 | 37 11 | 55 | 152 | 36 16 | 55 | 152 | 35 21 | 54 | 153 | 34 27 | 55 | 153 | 33 32 | 56 | 154 | 32 36 | 55 | 154 | 31 41 | 55 | 155 | 30 46 | 55 | 155 | 29 51 | 56 | 156 | 28 55 | 56 | 156 | 27 59 | 55 | 157 | 27 04 | 56 | 157 | 26 08 | 56 | 157 | 25 12 | 56 | 158 | 337 |
| 22 | 38 29 | 55 | 153 | 37 34 | 55 | 153 | 36 39 | 55 | 154 | 35 44 | 55 | 154 | 34 49 | 55 | 154 | 33 54 | 56 | 155 | 32 58 | 55 | 155 | 32 03 | 56 | 156 | 31 07 | 56 | 156 | 30 11 | 56 | 157 | 29 15 | 56 | 157 | 28 19 | 56 | 158 | 27 23 | 56 | 158 | 26 27 | 56 | 158 | 25 31 | 56 | 159 | 338 |
| 21 | 38 52 | 55 | 154 | 37 57 | 55 | 154 | 37 02 | 56 | 155 | 36 06 | 56 | 155 | 35 10 | 55 | 156 | 34 15 | 56 | 156 | 33 19 | 56 | 156 | 32 23 | 56 | 157 | 31 27 | 56 | 157 | 30 31 | 56 | 158 | 29 35 | 57 | 158 | 28 38 | 56 | 159 | 27 42 | 56 | 159 | 26 46 | 57 | 159 | 25 49 | 56 | 160 | 339 |
| 20 | 39 15 | −56 | 155 | 38 19 | −56 | 155 | 37 23 | −56 | 156 | 36 27 | −56 | 156 | 35 31 | −56 | 157 | 34 35 | −56 | 157 | 33 39 | −56 | 157 | 32 43 | −57 | 158 | 31 46 | −56 | 158 | 30 50 | −57 | 159 | 29 53 | −56 | 159 | 28 57 | −57 | 159 | 28 00 | −57 | 160 | 27 03 | −56 | 160 | 26 07 | −57 | 161 | 340 |
| 19 | 39 36 | 56 | 156 | 38 40 | 56 | 156 | 37 44 | 57 | 157 | 36 47 | 56 | 157 | 35 51 | 57 | 158 | 34 54 | 56 | 158 | 33 58 | 57 | 159 | 33 01 | 56 | 159 | 32 05 | 57 | 159 | 31 08 | 57 | 160 | 30 11 | 57 | 160 | 29 14 | 57 | 160 | 28 17 | 57 | 161 | 27 20 | 57 | 161 | 26 23 | 57 | 162 | 341 |
| 18 | 39 56 | 56 | 157 | 39 00 | 57 | 158 | 38 03 | 56 | 158 | 37 07 | 57 | 158 | 36 10 | 57 | 159 | 35 13 | 57 | 159 | 34 16 | 57 | 160 | 33 19 | 57 | 160 | 32 22 | 57 | 160 | 31 25 | 57 | 161 | 30 28 | 57 | 161 | 29 31 | 57 | 161 | 28 34 | 58 | 162 | 27 36 | 57 | 162 | 26 39 | 57 | 162 | 342 |
| 17 | 40 15 | 56 | 158 | 39 19 | 57 | 159 | 38 22 | 57 | 159 | 37 25 | 57 | 160 | 36 28 | 57 | 160 | 35 31 | 58 | 160 | 34 33 | 57 | 161 | 33 36 | 57 | 161 | 32 39 | 57 | 161 | 31 42 | 58 | 162 | 30 44 | 57 | 162 | 29 47 | 58 | 162 | 28 49 | 57 | 163 | 27 52 | 58 | 163 | 26 54 | 58 | 163 | 343 |
| 16 | 40 34 | 57 | 160 | 39 37 | 58 | 160 | 38 39 | 57 | 160 | 37 42 | 57 | 161 | 36 45 | 58 | 161 | 35 47 | 57 | 161 | 34 50 | 58 | 162 | 33 52 | 57 | 162 | 32 55 | 58 | 162 | 31 57 | 58 | 163 | 30 59 | 57 | 163 | 30 02 | 58 | 163 | 29 04 | 58 | 164 | 28 06 | 58 | 164 | 27 08 | 58 | 164 | 344 |
| 15 | 40 51 | −57 | 161 | 39 54 | −58 | 161 | 38 56 | −58 | 161 | 37 58 | −57 | 162 | 37 01 | −58 | 162 | 36 03 | −58 | 163 | 35 05 | −57 | 163 | 34 08 | −58 | 163 | 33 10 | −58 | 164 | 32 12 | −58 | 164 | 31 14 | −58 | 164 | 30 16 | −58 | 164 | 29 18 | −58 | 165 | 28 20 | −59 | 165 | 27 21 | −58 | 165 | 345 |
| 14 | 41 07 | 57 | 162 | 40 10 | 58 | 162 | 39 12 | 58 | 163 | 38 14 | 58 | 163 | 37 16 | 58 | 163 | 36 18 | 58 | 164 | 35 20 | 58 | 164 | 34 22 | 58 | 164 | 33 24 | 59 | 165 | 32 25 | 58 | 165 | 31 27 | 58 | 165 | 30 29 | 58 | 165 | 29 31 | 59 | 166 | 28 32 | 58 | 166 | 27 34 | 58 | 166 | 346 |
| 13 | 41 23 | 58 | 163 | 40 25 | 59 | 164 | 39 26 | 58 | 164 | 38 28 | 58 | 164 | 37 30 | 58 | 164 | 36 32 | 58 | 165 | 35 34 | 59 | 165 | 34 35 | 58 | 165 | 33 37 | 59 | 166 | 32 38 | 58 | 166 | 31 40 | 59 | 166 | 30 41 | 58 | 166 | 29 43 | 59 | 167 | 28 44 | 58 | 167 | 27 46 | 59 | 167 | 347 |
| 12 | 41 37 | 58 | 164 | 40 39 | 59 | 165 | 39 40 | 58 | 165 | 38 42 | 59 | 165 | 37 43 | 58 | 166 | 36 45 | 59 | 166 | 35 46 | 58 | 166 | 34 48 | 59 | 166 | 33 49 | 59 | 167 | 32 50 | 58 | 167 | 31 52 | 59 | 167 | 30 53 | 59 | 167 | 29 54 | 59 | 168 | 28 55 | 58 | 168 | 27 57 | 59 | 168 | 348 |
| 11 | 41 50 | 59 | 166 | 40 51 | 58 | 166 | 39 53 | 59 | 166 | 38 54 | 59 | 167 | 37 55 | 58 | 167 | 36 57 | 59 | 167 | 35 58 | 59 | 167 | 34 59 | 59 | 168 | 34 00 | 59 | 168 | 33 01 | 59 | 168 | 32 02 | 58 | 168 | 31 04 | 59 | 169 | 30 05 | 59 | 169 | 29 06 | 59 | 169 | 28 07 | 59 | 169 | 349 |
| 10 | 42 02 | −59 | 167 | 41 03 | −59 | 167 | 40 04 | −59 | 168 | 39 05 | −59 | 168 | 38 06 | −58 | 168 | 37 08 | −59 | 168 | 36 09 | −59 | 168 | 35 10 | −59 | 169 | 34 11 | −60 | 169 | 33 11 | −59 | 169 | 32 12 | −59 | 169 | 31 13 | −59 | 170 | 30 14 | −59 | 170 | 29 15 | −59 | 170 | 28 16 | −59 | 170 | 350 |
| 9 | 42 13 | 59 | 168 | 41 14 | 59 | 169 | 40 15 | 59 | 169 | 39 16 | 59 | 169 | 38 17 | 60 | 169 | 37 17 | 59 | 169 | 36 18 | 59 | 170 | 35 19 | 59 | 170 | 34 20 | 59 | 170 | 33 21 | 60 | 170 | 32 21 | 59 | 170 | 31 22 | 59 | 171 | 30 23 | 59 | 171 | 29 24 | 60 | 171 | 28 24 | 59 | 171 | 351 |
| 8 | 42 23 | 59 | 170 | 41 24 | 60 | 170 | 40 24 | 59 | 170 | 39 25 | 59 | 170 | 38 26 | 60 | 170 | 37 26 | 59 | 171 | 36 27 | 59 | 171 | 35 28 | 60 | 171 | 34 28 | 59 | 171 | 33 29 | 60 | 171 | 32 29 | 59 | 171 | 31 30 | 59 | 172 | 30 31 | 60 | 172 | 29 31 | 59 | 172 | 28 32 | 60 | 172 | 352 |
| 7 | 42 31 | 59 | 171 | 41 32 | 59 | 171 | 40 33 | 60 | 171 | 39 33 | 59 | 171 | 38 34 | 60 | 172 | 37 34 | 59 | 172 | 36 35 | 60 | 172 | 35 35 | 59 | 172 | 34 36 | 60 | 172 | 33 36 | 59 | 172 | 32 37 | 60 | 173 | 31 37 | 59 | 173 | 30 38 | 60 | 173 | 29 38 | 60 | 173 | 28 38 | 59 | 173 | 353 |
| 6 | 42 39 | 60 | 172 | 41 39 | 59 | 172 | 40 40 | 60 | 172 | 39 40 | 59 | 173 | 38 41 | 60 | 173 | 37 41 | 60 | 173 | 36 41 | 59 | 173 | 35 42 | 60 | 173 | 34 42 | 60 | 173 | 33 42 | 59 | 173 | 32 43 | 60 | 174 | 31 43 | 60 | 174 | 30 43 | 59 | 174 | 29 44 | 60 | 174 | 28 44 | 60 | 174 | 354 |
| 5 | 42 45 | −59 | 173 | 41 46 | −60 | 174 | 40 46 | −60 | 174 | 39 46 | −59 | 174 | 38 47 | −60 | 174 | 37 47 | −60 | 174 | 36 47 | −60 | 174 | 35 47 | −59 | 174 | 34 48 | −60 | 174 | 33 48 | −60 | 175 | 32 48 | −60 | 175 | 31 48 | −59 | 175 | 30 49 | −60 | 175 | 29 49 | −60 | 175 | 28 49 | −60 | 175 | 355 |
| 4 | 42 51 | 60 | 175 | 41 51 | 60 | 175 | 40 51 | 60 | 175 | 39 51 | 60 | 175 | 38 51 | 59 | 175 | 37 52 | 60 | 175 | 36 52 | 60 | 175 | 35 52 | 60 | 175 | 34 52 | 60 | 176 | 33 52 | 60 | 176 | 32 52 | 59 | 176 | 31 53 | 60 | 176 | 30 53 | 60 | 176 | 29 53 | 60 | 176 | 28 53 | 60 | 176 | 356 |
| 3 | 42 55 | 60 | 176 | 41 55 | 60 | 176 | 40 55 | 60 | 176 | 39 55 | 60 | 176 | 38 55 | 60 | 176 | 37 55 | 60 | 176 | 36 55 | 60 | 177 | 35 55 | 59 | 177 | 34 56 | 60 | 177 | 33 56 | 60 | 177 | 32 56 | 60 | 177 | 31 56 | 60 | 177 | 30 56 | 60 | 177 | 29 56 | 60 | 177 | 28 56 | 60 | 177 | 357 |
| 2 | 42 58 | 60 | 177 | 41 58 | 60 | 177 | 40 58 | 60 | 178 | 39 58 | 60 | 178 | 38 58 | 60 | 178 | 37 58 | 60 | 178 | 36 58 | 60 | 178 | 35 58 | 60 | 178 | 34 58 | 60 | 178 | 33 58 | 60 | 178 | 32 58 | 60 | 178 | 31 58 | 60 | 178 | 30 58 | 60 | 178 | 29 58 | 60 | 178 | 28 58 | 60 | 178 | 358 |
| 1 | 42 59 | 60 | 179 | 41 59 | 60 | 179 | 40 59 | 60 | 179 | 39 59 | 59 | 179 | 39 00 | 60 | 179 | 38 00 | 60 | 179 | 37 00 | 60 | 179 | 36 00 | 60 | 179 | 35 00 | 60 | 179 | 34 00 | 60 | 179 | 33 00 | 60 | 179 | 32 00 | 60 | 179 | 31 00 | 60 | 179 | 30 00 | 60 | 179 | 29 00 | 60 | 179 | 359 |
| 0 | 43 00 | −60 | 180 | 42 00 | −60 | 180 | 41 00 | −60 | 180 | 40 00 | −60 | 180 | 39 00 | −60 | 180 | 38 00 | −60 | 180 | 37 00 | −60 | 180 | 36 00 | −60 | 180 | 35 00 | −60 | 180 | 34 00 | −60 | 180 | 33 00 | −60 | 180 | 32 00 | −60 | 180 | 31 00 | −60 | 180 | 30 00 | −60 | 180 | 29 00 | −60 | 180 | 360 |
| | 15° | | | 16° | | | 17° | | | 18° | | | 19° | | | 20° | | | 21° | | | 22° | | | 23° | | | 24° | | | 25° | | | 26° | | | 27° | | | 28° | | | 29° | | | |

LAT 32°

S. Lat. {LHA greater than 180°.......Zn=180−Z
{LHA less than 180°..........Zn=180+Z

DECLINATION (15°-29°) CONTRARY NAME TO LATITUDE

LAT 32°

FIGURE 151.—Declination (15° - 29°) LAT 32°.

## TABLE 5.—Correction to Tabulated Altitude for Minutes of Declination

| d / ′ | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | d / ′ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 5 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 6 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 7 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 7 |
| 8 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 |
| 9 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 9 | 9 | 9 | 9 | 9 |
| 10 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 9 | 9 | 9 | 9 | 9 | 10 | 10 | 10 | 10 | 10 |
| 11 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 | 9 | 9 | 9 | 9 | 9 | 10 | 10 | 10 | 10 | 10 | 10 | 11 | 11 | 11 | 11 |
| 12 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 9 | 9 | 9 | 9 | 9 | 10 | 10 | 10 | 10 | 10 | 11 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 |
| 13 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 9 | 9 | 9 | 9 | 10 | 10 | 10 | 10 | 10 | 11 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 13 | 13 | 13 | 13 |
| 14 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 9 | 9 | 9 | 9 | 10 | 10 | 10 | 10 | 10 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 13 | 13 | 13 | 13 | 14 | 14 | 14 | 14 |
| 15 | 0 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 9 | 9 | 9 | 10 | 10 | 10 | 10 | 10 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 | 13 | 13 | 13 | 14 | 14 | 14 | 14 | 14 | 15 | 15 | 15 |
| 16 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 9 | 9 | 9 | 9 | 10 | 10 | 10 | 10 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 13 | 13 | 13 | 13 | 14 | 14 | 14 | 14 | 15 | 15 | 15 | 15 | 16 | 16 | 16 |
| 17 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 9 | 9 | 9 | 10 | 10 | 10 | 10 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 13 | 13 | 13 | 14 | 14 | 14 | 14 | 15 | 15 | 15 | 16 | 16 | 16 | 16 | 17 | 17 | 17 |
| 18 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 6 | 6 | 6 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 9 | 9 | 9 | 10 | 10 | 10 | 10 | 11 | 11 | 11 | 12 | 12 | 12 | 13 | 13 | 13 | 14 | 14 | 14 | 14 | 15 | 15 | 15 | 16 | 16 | 16 | 16 | 17 | 17 | 17 | 18 | 18 | 18 |
| 19 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 5 | 6 | 6 | 6 | 7 | 7 | 7 | 8 | 8 | 8 | 9 | 9 | 9 | 10 | 10 | 10 | 10 | 11 | 11 | 11 | 12 | 12 | 12 | 13 | 13 | 13 | 14 | 14 | 14 | 15 | 15 | 15 | 16 | 16 | 16 | 16 | 17 | 17 | 17 | 18 | 18 | 18 | 19 | 19 | 19 |
| 20 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 5 | 6 | 6 | 6 | 7 | 7 | 7 | 8 | 8 | 8 | 9 | 9 | 9 | 10 | 10 | 10 | 11 | 11 | 11 | 12 | 12 | 12 | 13 | 13 | 13 | 14 | 14 | 14 | 15 | 15 | 15 | 16 | 16 | 16 | 17 | 17 | 17 | 18 | 18 | 18 | 19 | 19 | 19 | 20 | 20 | 20 |
| 21 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 5 | 6 | 6 | 6 | 7 | 7 | 7 | 8 | 8 | 8 | 9 | 9 | 9 | 10 | 10 | 10 | 11 | 11 | 12 | 12 | 12 | 13 | 13 | 13 | 14 | 14 | 14 | 15 | 15 | 15 | 16 | 16 | 16 | 17 | 17 | 18 | 18 | 18 | 19 | 19 | 19 | 20 | 20 | 20 | 21 | 21 | 21 |
| 22 | 0 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 6 | 6 | 6 | 7 | 7 | 7 | 8 | 8 | 8 | 9 | 9 | 10 | 10 | 10 | 11 | 11 | 11 | 12 | 12 | 12 | 13 | 13 | 14 | 14 | 14 | 15 | 15 | 15 | 16 | 16 | 16 | 17 | 17 | 18 | 18 | 18 | 19 | 19 | 19 | 20 | 20 | 21 | 21 | 21 | 22 | 22 | 22 |
| 23 | 0 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 5 | 5 | 5 | 6 | 6 | 7 | 7 | 7 | 8 | 8 | 8 | 9 | 9 | 10 | 10 | 10 | 11 | 11 | 12 | 12 | 12 | 13 | 13 | 13 | 14 | 14 | 15 | 15 | 15 | 16 | 16 | 16 | 17 | 17 | 18 | 18 | 18 | 19 | 19 | 20 | 20 | 20 | 21 | 21 | 21 | 22 | 22 | 23 | 23 | 23 |
| 24 | 0 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 6 | 6 | 6 | 7 | 7 | 8 | 8 | 8 | 9 | 9 | 10 | 10 | 10 | 11 | 11 | 12 | 12 | 12 | 13 | 13 | 14 | 14 | 14 | 15 | 15 | 16 | 16 | 16 | 17 | 17 | 18 | 18 | 18 | 19 | 19 | 20 | 20 | 20 | 21 | 21 | 22 | 22 | 22 | 23 | 23 | 24 | 24 | 24 |
| 25 | 0 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 4 | 4 | 5 | 5 | 5 | 6 | 6 | 7 | 7 | 8 | 8 | 8 | 9 | 9 | 10 | 10 | 10 | 11 | 11 | 12 | 12 | 12 | 13 | 13 | 14 | 14 | 15 | 15 | 15 | 16 | 16 | 17 | 17 | 18 | 18 | 18 | 19 | 19 | 20 | 20 | 20 | 21 | 21 | 22 | 22 | 22 | 23 | 23 | 24 | 24 | 25 | 25 | 25 |
| 26 | 0 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 5 | 5 | 6 | 6 | 6 | 7 | 7 | 8 | 8 | 9 | 9 | 10 | 10 | 10 | 11 | 11 | 12 | 12 | 13 | 13 | 13 | 14 | 14 | 15 | 15 | 16 | 16 | 16 | 17 | 17 | 18 | 18 | 19 | 19 | 20 | 20 | 20 | 21 | 21 | 22 | 22 | 23 | 23 | 23 | 24 | 24 | 25 | 25 | 26 | 26 | 26 |
| 27 | 0 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 7 | 8 | 8 | 9 | 9 | 9 | 10 | 10 | 11 | 11 | 12 | 12 | 13 | 13 | 14 | 14 | 14 | 15 | 15 | 16 | 16 | 17 | 17 | 18 | 18 | 18 | 19 | 19 | 20 | 20 | 21 | 21 | 22 | 22 | 22 | 23 | 23 | 24 | 24 | 25 | 25 | 26 | 26 | 27 | 27 | 27 |
| 28 | 0 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 7 | 7 | 8 | 8 | 9 | 9 | 10 | 10 | 11 | 11 | 12 | 12 | 13 | 13 | 14 | 14 | 14 | 15 | 15 | 16 | 16 | 17 | 17 | 18 | 18 | 19 | 19 | 20 | 20 | 21 | 21 | 21 | 22 | 22 | 23 | 23 | 24 | 24 | 25 | 25 | 26 | 26 | 27 | 27 | 28 | 28 | 28 |
| 29 | 0 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 7 | 8 | 8 | 9 | 9 | 10 | 10 | 11 | 11 | 12 | 12 | 13 | 13 | 14 | 14 | 14 | 15 | 15 | 16 | 16 | 17 | 17 | 18 | 18 | 19 | 19 | 20 | 20 | 21 | 21 | 22 | 22 | 23 | 23 | 24 | 24 | 25 | 25 | 26 | 26 | 27 | 27 | 28 | 28 | 29 | 29 | 29 |
| 30 | 0 | 1 | 2 | 2 | 2 | 3 | 4 | 4 | 4 | 5 | 6 | 6 | 6 | 7 | 8 | 8 | 8 | 9 | 10 | 10 | 10 | 11 | 12 | 12 | 12 | 13 | 14 | 14 | 14 | 15 | 16 | 16 | 16 | 17 | 18 | 18 | 18 | 19 | 20 | 20 | 20 | 21 | 22 | 22 | 22 | 23 | 24 | 24 | 24 | 25 | 26 | 26 | 26 | 27 | 28 | 28 | 28 | 29 | 30 | 30 | 30 |
| 31 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 7 | 8 | 8 | 9 | 9 | 10 | 10 | 11 | 11 | 12 | 12 | 13 | 13 | 14 | 14 | 15 | 16 | 16 | 17 | 17 | 18 | 18 | 19 | 19 | 20 | 20 | 21 | 21 | 22 | 22 | 23 | 23 | 24 | 24 | 25 | 25 | 26 | 26 | 27 | 27 | 28 | 28 | 29 | 29 | 30 | 30 | 31 | 31 |
| 32 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 7 | 8 | 9 | 9 | 10 | 10 | 11 | 11 | 12 | 12 | 13 | 13 | 14 | 14 | 15 | 15 | 16 | 17 | 17 | 18 | 18 | 19 | 19 | 20 | 20 | 21 | 21 | 22 | 22 | 23 | 23 | 24 | 25 | 25 | 26 | 26 | 27 | 27 | 28 | 28 | 29 | 29 | 30 | 30 | 31 | 31 | 32 | 32 |
| 33 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 | 6 | 6 | 7 | 7 | 8 | 8 | 9 | 9 | 10 | 10 | 11 | 12 | 12 | 13 | 13 | 14 | 14 | 15 | 15 | 16 | 16 | 17 | 18 | 18 | 19 | 19 | 20 | 20 | 21 | 21 | 22 | 23 | 23 | 24 | 24 | 25 | 25 | 26 | 26 | 27 | 28 | 28 | 29 | 29 | 30 | 30 | 31 | 31 | 32 | 32 | 33 | 33 |
| 34 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 5 | 5 | 6 | 6 | 7 | 7 | 8 | 8 | 9 | 10 | 10 | 11 | 11 | 12 | 12 | 13 | 14 | 14 | 15 | 15 | 16 | 16 | 17 | 18 | 18 | 19 | 19 | 20 | 20 | 21 | 22 | 22 | 23 | 23 | 24 | 24 | 25 | 26 | 26 | 27 | 27 | 28 | 28 | 29 | 29 | 30 | 31 | 31 | 32 | 32 | 33 | 33 | 34 | 34 |
| 35 | 1 | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 8 | 8 | 9 | 9 | 10 | 10 | 11 | 12 | 12 | 13 | 13 | 14 | 15 | 15 | 16 | 16 | 17 | 18 | 18 | 19 | 19 | 20 | 20 | 21 | 22 | 22 | 23 | 23 | 24 | 24 | 25 | 26 | 26 | 27 | 27 | 28 | 29 | 29 | 30 | 30 | 31 | 32 | 32 | 33 | 33 | 34 | 34 | 35 | 35 |
| 36 | 1 | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 5 | 6 | 7 | 7 | 8 | 8 | 9 | 10 | 10 | 11 | 11 | 12 | 13 | 13 | 14 | 14 | 15 | 16 | 16 | 17 | 17 | 18 | 19 | 19 | 20 | 20 | 21 | 22 | 22 | 23 | 23 | 24 | 25 | 25 | 26 | 26 | 27 | 28 | 28 | 29 | 29 | 30 | 31 | 31 | 32 | 32 | 33 | 34 | 34 | 35 | 35 | 36 | 36 |
| 37 | 1 | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 6 | 6 | 7 | 7 | 8 | 9 | 9 | 10 | 10 | 11 | 12 | 12 | 13 | 14 | 14 | 15 | 15 | 16 | 17 | 17 | 18 | 18 | 19 | 20 | 20 | 21 | 22 | 22 | 23 | 23 | 24 | 25 | 25 | 26 | 27 | 27 | 28 | 28 | 29 | 30 | 30 | 31 | 31 | 32 | 33 | 33 | 34 | 35 | 35 | 36 | 36 | 37 | 37 |
| 38 | 1 | 1 | 2 | 3 | 3 | 4 | 4 | 5 | 6 | 6 | 7 | 8 | 8 | 9 | 10 | 10 | 11 | 11 | 12 | 13 | 13 | 14 | 15 | 15 | 16 | 16 | 17 | 18 | 18 | 19 | 20 | 20 | 21 | 22 | 22 | 23 | 23 | 24 | 25 | 25 | 26 | 27 | 27 | 28 | 28 | 29 | 30 | 30 | 31 | 32 | 32 | 33 | 34 | 34 | 35 | 35 | 36 | 37 | 37 | 38 | 38 |
| 39 | 1 | 1 | 2 | 3 | 3 | 4 | 5 | 5 | 6 | 6 | 7 | 8 | 8 | 9 | 10 | 10 | 11 | 12 | 12 | 13 | 14 | 14 | 15 | 16 | 16 | 17 | 18 | 18 | 19 | 20 | 20 | 21 | 21 | 22 | 23 | 23 | 24 | 25 | 25 | 26 | 27 | 27 | 28 | 29 | 29 | 30 | 31 | 31 | 32 | 32 | 33 | 34 | 34 | 35 | 36 | 36 | 37 | 38 | 38 | 39 | 39 |
| 40 | 1 | 1 | 2 | 3 | 3 | 4 | 5 | 5 | 6 | 7 | 7 | 8 | 9 | 9 | 10 | 11 | 11 | 12 | 13 | 13 | 14 | 15 | 15 | 16 | 17 | 17 | 18 | 19 | 19 | 20 | 21 | 21 | 22 | 23 | 23 | 24 | 25 | 25 | 26 | 27 | 27 | 28 | 29 | 29 | 30 | 31 | 31 | 32 | 33 | 33 | 34 | 35 | 35 | 36 | 37 | 37 | 38 | 39 | 39 | 40 | 40 |
| 41 | 1 | 1 | 2 | 3 | 3 | 4 | 5 | 5 | 6 | 7 | 8 | 8 | 9 | 10 | 10 | 11 | 12 | 12 | 13 | 14 | 14 | 15 | 16 | 16 | 17 | 18 | 18 | 19 | 20 | 20 | 21 | 22 | 23 | 23 | 24 | 25 | 25 | 26 | 27 | 27 | 28 | 29 | 29 | 30 | 31 | 31 | 32 | 33 | 33 | 34 | 35 | 36 | 36 | 37 | 38 | 38 | 39 | 40 | 40 | 41 | 41 |
| 42 | 1 | 1 | 2 | 3 | 4 | 4 | 5 | 6 | 6 | 7 | 8 | 8 | 9 | 10 | 10 | 11 | 12 | 13 | 13 | 14 | 15 | 15 | 16 | 17 | 18 | 18 | 19 | 20 | 20 | 21 | 22 | 22 | 23 | 24 | 24 | 25 | 26 | 27 | 27 | 28 | 29 | 29 | 30 | 31 | 32 | 32 | 33 | 34 | 34 | 35 | 36 | 36 | 37 | 38 | 38 | 39 | 40 | 41 | 41 | 42 | 42 |
| 43 | 1 | 1 | 2 | 3 | 4 | 4 | 5 | 6 | 6 | 7 | 8 | 9 | 9 | 10 | 11 | 11 | 12 | 13 | 14 | 14 | 15 | 16 | 16 | 17 | 18 | 19 | 19 | 20 | 21 | 22 | 22 | 23 | 24 | 24 | 25 | 26 | 27 | 27 | 28 | 29 | 29 | 30 | 31 | 32 | 32 | 33 | 34 | 34 | 35 | 36 | 37 | 37 | 38 | 39 | 39 | 40 | 41 | 42 | 42 | 43 | 43 |
| 44 | 1 | 1 | 2 | 3 | 4 | 4 | 5 | 6 | 7 | 7 | 8 | 9 | 10 | 10 | 11 | 12 | 12 | 13 | 14 | 15 | 15 | 16 | 17 | 18 | 18 | 19 | 20 | 21 | 21 | 22 | 23 | 23 | 24 | 25 | 26 | 26 | 27 | 28 | 29 | 29 | 30 | 31 | 32 | 32 | 33 | 34 | 34 | 35 | 36 | 37 | 37 | 38 | 39 | 40 | 40 | 41 | 42 | 43 | 43 | 44 | 44 |
| 45 | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 6 | 7 | 8 | 8 | 9 | 10 | 10 | 11 | 12 | 13 | 14 | 14 | 15 | 16 | 16 | 17 | 18 | 19 | 20 | 20 | 21 | 22 | 22 | 23 | 24 | 25 | 26 | 26 | 27 | 28 | 28 | 29 | 30 | 31 | 32 | 32 | 33 | 34 | 34 | 35 | 36 | 37 | 38 | 38 | 39 | 40 | 40 | 41 | 42 | 43 | 44 | 44 | 45 | 45 |
| 46 | 1 | 2 | 2 | 3 | 4 | 5 | 5 | 6 | 7 | 8 | 8 | 9 | 10 | 11 | 12 | 12 | 13 | 14 | 15 | 15 | 16 | 17 | 18 | 18 | 19 | 20 | 21 | 21 | 22 | 23 | 24 | 25 | 25 | 26 | 27 | 28 | 28 | 29 | 30 | 31 | 31 | 32 | 33 | 34 | 34 | 35 | 36 | 37 | 38 | 38 | 39 | 40 | 41 | 41 | 42 | 43 | 44 | 44 | 45 | 46 | 46 |
| 47 | 1 | 2 | 2 | 3 | 4 | 5 | 5 | 6 | 7 | 8 | 9 | 9 | 10 | 11 | 12 | 13 | 13 | 14 | 15 | 16 | 16 | 17 | 18 | 19 | 20 | 20 | 21 | 22 | 23 | 24 | 24 | 25 | 26 | 27 | 27 | 28 | 29 | 30 | 31 | 31 | 32 | 33 | 34 | 34 | 35 | 36 | 37 | 38 | 38 | 39 | 40 | 41 | 42 | 42 | 43 | 44 | 45 | 45 | 46 | 47 | 47 |
| 48 | 1 | 2 | 2 | 3 | 4 | 5 | 6 | 6 | 7 | 8 | 9 | 10 | 10 | 11 | 12 | 13 | 14 | 14 | 15 | 16 | 17 | 18 | 18 | 19 | 20 | 21 | 22 | 22 | 23 | 24 | 25 | 26 | 26 | 27 | 28 | 29 | 30 | 30 | 31 | 32 | 33 | 34 | 34 | 35 | 36 | 37 | 38 | 38 | 39 | 40 | 41 | 42 | 42 | 43 | 44 | 45 | 46 | 46 | 47 | 48 | 48 |
| 49 | 1 | 2 | 2 | 3 | 4 | 5 | 6 | 7 | 7 | 8 | 9 | 10 | 11 | 11 | 12 | 13 | 14 | 15 | 16 | 16 | 17 | 18 | 19 | 20 | 20 | 21 | 22 | 23 | 24 | 24 | 25 | 26 | 27 | 28 | 29 | 29 | 30 | 31 | 32 | 33 | 33 | 34 | 35 | 36 | 37 | 38 | 38 | 39 | 40 | 41 | 42 | 42 | 43 | 44 | 45 | 46 | 47 | 47 | 48 | 49 | 49 |
| 50 | 1 | 2 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 8 | 9 | 10 | 11 | 12 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 18 | 19 | 20 | 21 | 22 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 28 | 29 | 30 | 31 | 32 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 38 | 39 | 40 | 41 | 42 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 48 | 49 | 50 | 50 |
| 51 | 1 | 2 | 3 | 3 | 4 | 5 | 6 | 7 | 8 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 26 | 27 | 28 | 29 | 30 | 31 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 37 | 38 | 39 | 40 | 41 | 42 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 48 | 49 | 50 | 51 | 51 |
| 52 | 1 | 2 | 3 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 49 | 50 | 51 | 52 | 52 |
| 53 | 1 | 2 | 3 | 4 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 49 | 50 | 51 | 52 | 53 | 53 |
| 54 | 1 | 2 | 3 | 4 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 50 | 51 | 52 | 53 | 54 | 54 |
| 55 | 1 | 2 | 3 | 4 | 5 | 6 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 50 | 51 | 52 | 53 | 54 | 55 | 55 |
| 56 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 56 |
| 57 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 57 |
| 58 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 58 |
| 59 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 59 |

FIGURE 152.—Tabulated Altitude Correction Table.

## TABLE 1.—Altitude Correction for Change in Position of Observer

### Correction for 4 Minutes of Time

| Rel. Zn | Ground Speed in Knots | | | | | | | | | | | | | | | | | | Rel. Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 50 | 100 | 150 | 200 | 250, | 300 | 350 | 400 | 450 | 500 | 550 | 600 | 650 | 700 | 750 | 800 | 850 | 900 | |
| ° | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ′ | ° |
| 000 | +3 | +7 | +10 | +13 | +17 | +20 | +23 | +27 | +30 | +33 | +37 | +40 | +43 | +47 | +50 | +53 | +57 | +60 | 000 |
| 005 | 3 | 7 | 10 | 13 | 17 | 20 | 23 | 27 | 30 | 33 | 37 | 40 | 43 | 46 | 50 | 53 | 56 | 60 | 355 |
| 010 | 3 | 7 | 10 | 13 | 16 | 20 | 23 | 26 | 30 | 33 | 36 | 39 | 43 | 46 | 49 | 53 | 56 | 59 | 350 |
| 015 | 3 | 6 | 10 | 13 | 16 | 19 | 23 | 26 | 29 | 32 | 35 | 39 | 42 | 45 | 48 | 52 | 55 | 58 | 345 |
| 020 | 3 | 6 | 9 | 13 | 16 | 19 | 22 | 25 | 28 | 31 | 34 | 38 | 41 | 44 | 47 | 50 | 53 | 56 | 340 |
| 025 | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 36 | 39 | 42 | 45 | 48 | 51 | 54 | 335 |
| 030 | +3 | +6 | +9 | +12 | +14 | +17 | +20 | +23 | +26 | +29 | +32 | +35 | +38 | +40 | +43 | +46 | +49 | +52 | 330 |
| 035 | 3 | 5 | 8 | 11 | 14 | 16 | 19 | 22 | 25 | 27 | 30 | 33 | 35 | 38 | 41 | 44 | 46 | 49 | 325 |
| 040 | 3 | 5 | 8 | 10 | 13 | 15 | 18 | 20 | 23 | 26 | 28 | 31 | 33 | 36 | 38 | 41 | 43 | 46 | 320 |
| 045 | 2 | 5 | 7 | 9 | 12 | 14 | 16 | 19 | 21 | 24 | 26 | 28 | 31 | 33 | 35 | 38 | 40 | 42 | 315 |
| 050 | 2 | 4 | 6 | 9 | 11 | 13 | 15 | 17 | 19 | 21 | 24 | 26 | 28 | 30 | 32 | 34 | 36 | 39 | 310 |
| 055 | 2 | 4 | 6 | 8 | 10 | 11 | 13 | 15 | 17 | 19 | 21 | 23 | 25 | 27 | 29 | 31 | 33 | 34 | 305 |
| 060 | +2 | +3 | +5 | +7 | +8 | +10 | +12 | +13 | +15 | +17 | +18 | +20 | +22 | +23 | +25 | +27 | +28 | +30 | 300 |
| 065 | 1 | 3 | 4 | 6 | 7 | 8 | 10 | 11 | 13 | 14 | 15 | 17 | 18 | 20 | 21 | 23 | 24 | 25 | 295 |
| 070 | 1 | 2 | 3 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 21 | 290 |
| 075 | 1 | 2 | 3 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 285 |
| 080 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 5 | 5 | 6 | 6 | 7 | 8 | 8 | 9 | 9 | 10 | 10 | 280 |
| 085 | +0 | +1 | +1 | +1 | +1 | +2 | +2 | +2 | +3 | +3 | +3 | +3 | +4 | +4 | +4 | +5 | +5 | +5 | 275 |
| 090 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 270 |
| 095 | −0 | −1 | −1 | −1 | −1 | −2 | −2 | −2 | −3 | −3 | −3 | −3 | −4 | −4 | −4 | −5 | −5 | −5 | 265 |
| 100 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 5 | 5 | 6 | 6 | 7 | 8 | 8 | 9 | 9 | 10 | 10 | 260 |
| 105 | 1 | 2 | 3 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 255 |
| 110 | 1 | 2 | 3 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 21 | 250 |
| 115 | 1 | 3 | 4 | 6 | 7 | 8 | 10 | 11 | 13 | 14 | 15 | 17 | 18 | 20 | 21 | 23 | 24 | 25 | 245 |
| 120 | 2 | 3 | 5 | 7 | 8 | 10 | 12 | 13 | 15 | 17 | 18 | 20 | 22 | 23 | 25 | 27 | 28 | 30 | 240 |
| 125 | −2 | −4 | −6 | −8 | −10 | −11 | −13 | −15 | −17 | −19 | −21 | −23 | −25 | −27 | −29 | −31 | −33 | −34 | 235 |
| 130 | 2 | 4 | 6 | 9 | 11 | 13 | 15 | 17 | 19 | 21 | 24 | 26 | 28 | 30 | 32 | 34 | 36 | 39 | 230 |
| 135 | 2 | 5 | 7 | 9 | 12 | 14 | 16 | 19 | 21 | 24 | 26 | 28 | 31 | 33 | 35 | 38 | 40 | 42 | 225 |
| 140 | 3 | 5 | 8 | 10 | 13 | 15 | 18 | 20 | 23 | 26 | 28 | 31 | 33 | 36 | 38 | 41 | 43 | 46 | 220 |
| 145 | 3 | 5 | 8 | 11 | 14 | 16 | 19 | 22 | 25 | 27 | 30 | 33 | 35 | 38 | 41 | 44 | 46 | 49 | 215 |
| 150 | 3 | 6 | 9 | 12 | 14 | 17 | 20 | 23 | 26 | 29 | 32 | 35 | 38 | 40 | 43 | 46 | 49 | 52 | 210 |
| 155 | −3 | −6 | −9 | −12 | −15 | −18 | −21 | −24 | −27 | −30 | −33 | −36 | −39 | −42 | −45 | −48 | −51 | −54 | 205 |
| 160 | 3 | 6 | 9 | 13 | 16 | 19 | 22 | 25 | 28 | 31 | 34 | 38 | 41 | 44 | 47 | 50 | 53 | 56 | 200 |
| 165 | 3 | 6 | 10 | 13 | 16 | 19 | 23 | 26 | 29 | 32 | 35 | 39 | 42 | 45 | 48 | 52 | 55 | 58 | 195 |
| 170 | 3 | 7 | 10 | 13 | 16 | 20 | 23 | 26 | 30 | 33 | 36 | 39 | 43 | 46 | 49 | 53 | 56 | 59 | 190 |
| 175 | 3 | 7 | 10 | 13 | 17 | 20 | 23 | 27 | 30 | 33 | 37 | 40 | 43 | 46 | 50 | 53 | 56 | 60 | 185 |
| 180 | −3 | −7 | −10 | −13 | −17 | −20 | −23 | −27 | −30 | −33 | −37 | −40 | −43 | −47 | −50 | −53 | −57 | −60 | 180 |

| Time of fix (tab 1) or computation (tab 2) | Sign from 4-min. Table | To observed altitude | To tabulated altitude | To Intercept |
|---|---|---|---|---|
| Later than observation | + | Add | Subtract | Toward |
| | − | Subtract | Add | Away |
| Earlier than observation | + | Subtract | Add | Away |
| | − | Add | Subtract | Toward |

FIGURE 153.—Altitude Correction for Position Table.

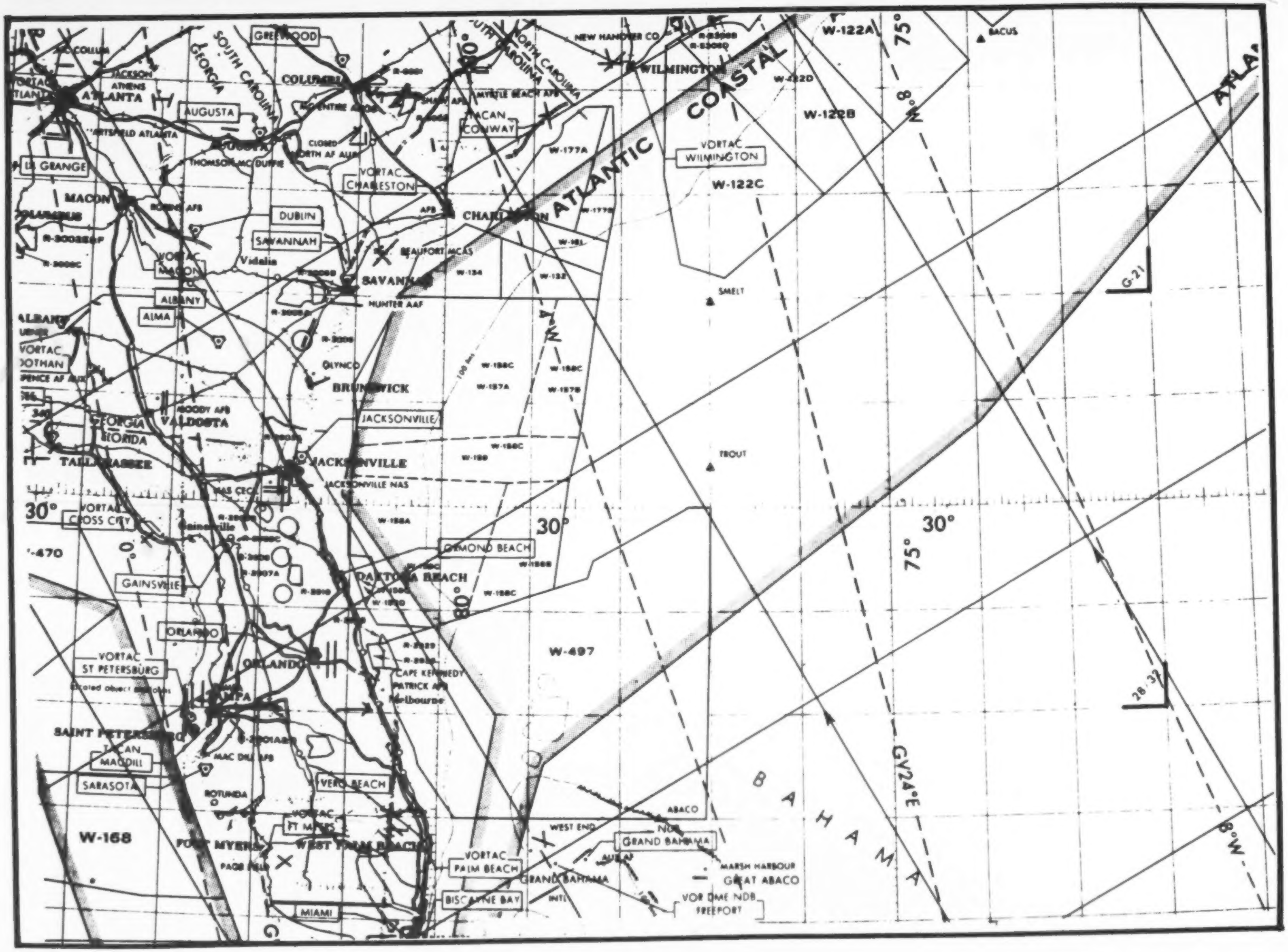

GREENWOOD
GEORGIA
SOUTH CAROLINA
NORTH CAROLINA
NEW HANOVER CO
WILMINGTON
W-122A
75°
W-122D
W-122B
ATLANTA
AUGUSTA
COLUMBIA
TACAN CONWAY
MYRTLE BEACH AFB
ATLANTIC COASTAL
ATLA.
VORTAC WILMINGTON
W-122C
LA GRANGE
MACON
VORTAC CHARLESTON
CHARLESTON
W-177A
DUBLIN
SAVANNAH
Vidalia
BEAUFORT MCAS
VORTAC MACON
ALBANY
ALMA
SAVANNAH
HUNTER AAF
W-134
W-132
SMELT
G-21
VORTAC DOTHAN
GLYNCO
BRUNSWICK
W-158C
W-157A
W-157B
MOODY AFB
GEORGIA
FLORIDA
VALDOSTA
JACKSONVILLE
TALLAHASSEE
JACKSONVILLE
JACKSONVILLE NAS
W-159
W-158C
TROUT
30°
VORTAC CROSS CITY
W-158A
W-470
GAINSVILLE
Gainesville
ORMOND BEACH
DAYTONA BEACH
75°
30°
W-158B
W-158C
80°
ORLANDO
ORLANDO
W-497
VORTAC ST PETERSBURG
CAPE KENNEDY
PATRICK AFB
Melbourne
28°32'
TAMPA
SAINT PETERSBURG
TACAN MACDILL
MAC DILL AFB
SARASOTA
VERO BEACH
GV24°E
BAHAMA
ROTUNDA
W-168
VORTAC FT MYERS
FORT MYERS
WEST PALM BEACH
ABACO
WEST END
NDB GRAND BAHAMA
VORTAC PALM BEACH
GRAND BAHAMA
INTL
MARSH HARBOUR
GREAT ABACO
VOR DME NDB FREEPORT
BISCAYNE BAY
MIAMI
8°W
BACUS

FIGURE 154.—Navigation Chart.

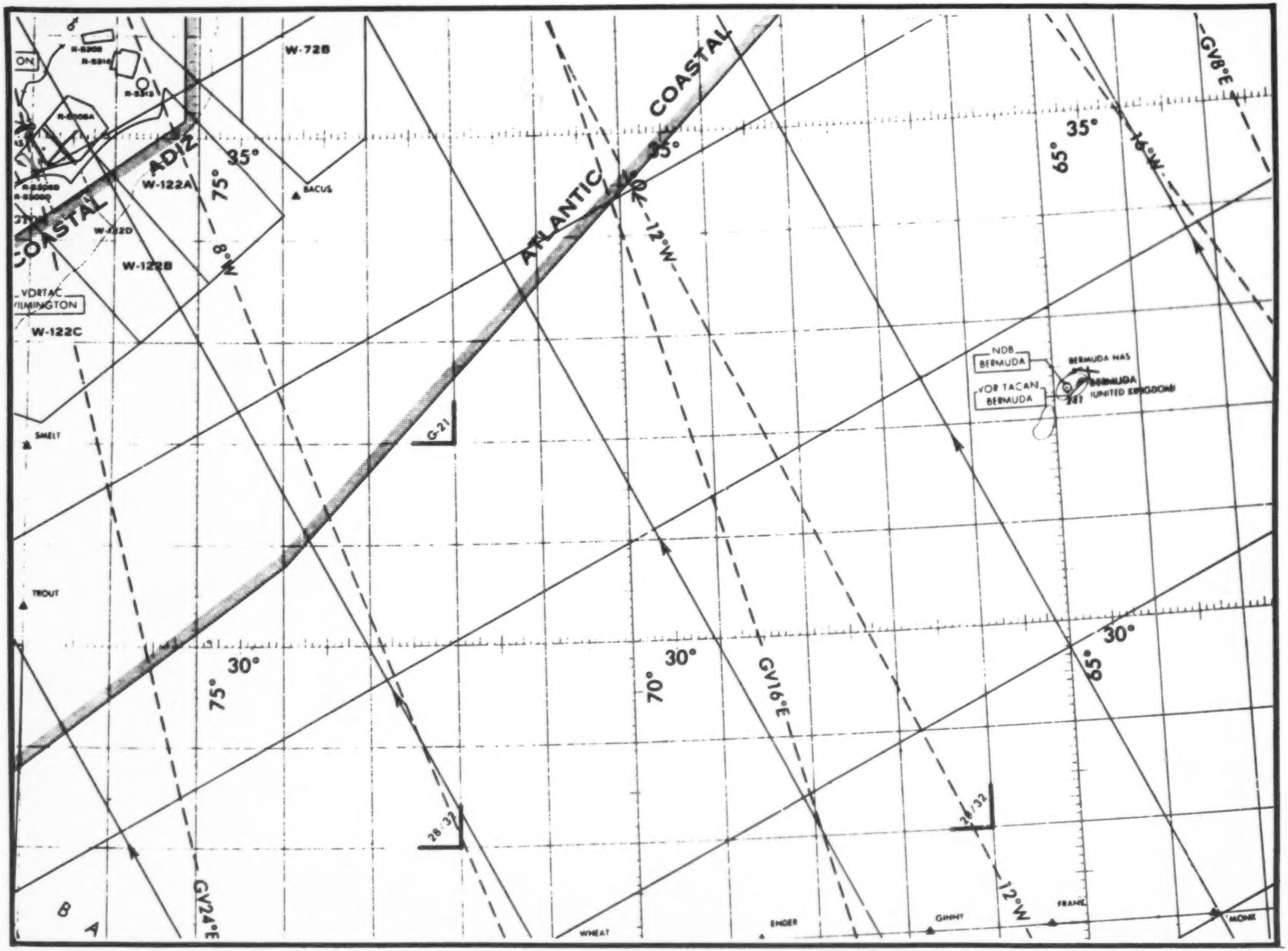

W-72B
R-5306
R-5314
R-5313
ON
W-122A
W-122D
W-122B
W-122C
VORTAC
WILMINGTON
COASTAL
ADIZ
ATLANTIC
COASTAL
35°
75°
8°W
BACUS
SMELT
TROUT
G-21
12°W
GV8°E
16°W
65°
35°
NDB
BERMUDA
BERMUDA NAS
VOR TACAN
BERMUDA
BERMUDA
(UNITED KINGDOM)
30°
75°
30°
70°
GV16°E
30°
65°
28/32
28/32
GV24°E
12°W
B
A
WHEAT
ENDER
GINNY
FRANK
MONK

FIGURE 155.—Navigation Chart.

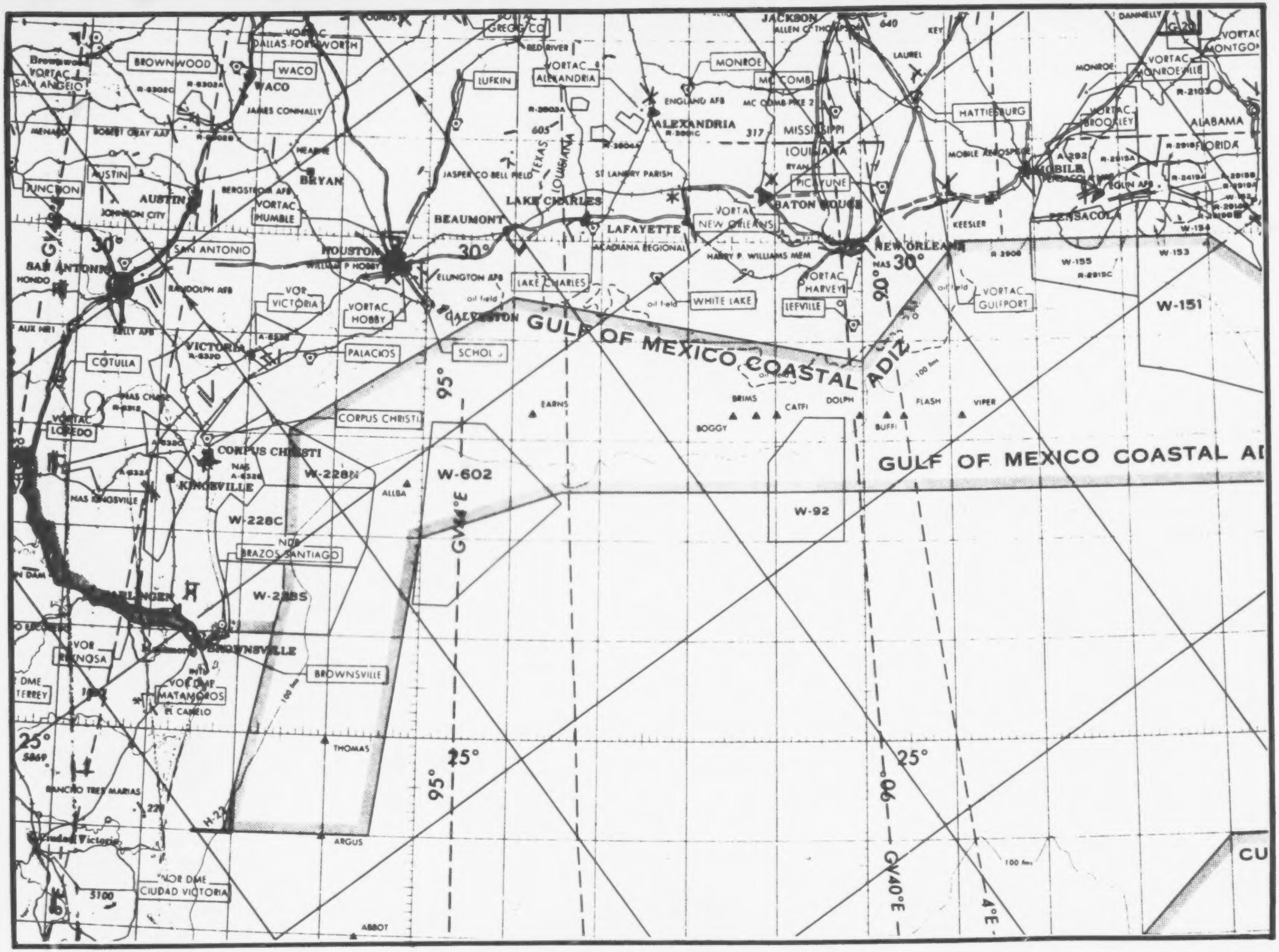

GULF OF MEXICO COASTAL ADIZ
GULF OF MEXICO COASTAL AI
BROWNWOOD
DALLAS-FORT WORTH
WACO
GREGG CO
LUFKIN
ALEXANDRIA
MONROE
JACKSON
MC COMB
HATTIESBURG
MONTGOMERY
BROOKLEY
ALABAMA
FLORIDA
MISSISSIPPI
LOUISIANA
TEXAS
SAN ANGELO
JUNCTION
AUSTIN
BRYAN
HUMBLE
SAN ANTONIO
HOUSTON
BEAUMONT
LAKE CHARLES
LAFAYETTE
BATON ROUGE
PICAYUNE
NEW ORLEANS
MOBILE
PENSACOLA
KEESLER
GULFPORT
HARVEY
LEEVILLE
WHITE LAKE
VICTORIA
HOBBY
PALACIOS
GALVESTON
SCHOL
COTULLA
LAREDO
CORPUS CHRISTI
KINGSVILLE
BRAZOS SANTIAGO
HARLINGEN
BROWNSVILLE
REYNOSA
MATAMOROS
CIUDAD VICTORIA
W-602
W-228B
W-228C
W-228S
W-92
W-151
W-155
W-153
W-154
EARNS
BRIMS
BOGGY
CATFI
DOLPH
BUFFI
FLASH
VIPER
ALLBA
THOMAS
ARGUS
ABBOT
30°
25°
95°
90°
GV4°E
GV40°E
4°E
100 fms

FIGURE 156.—Navigation Chart.

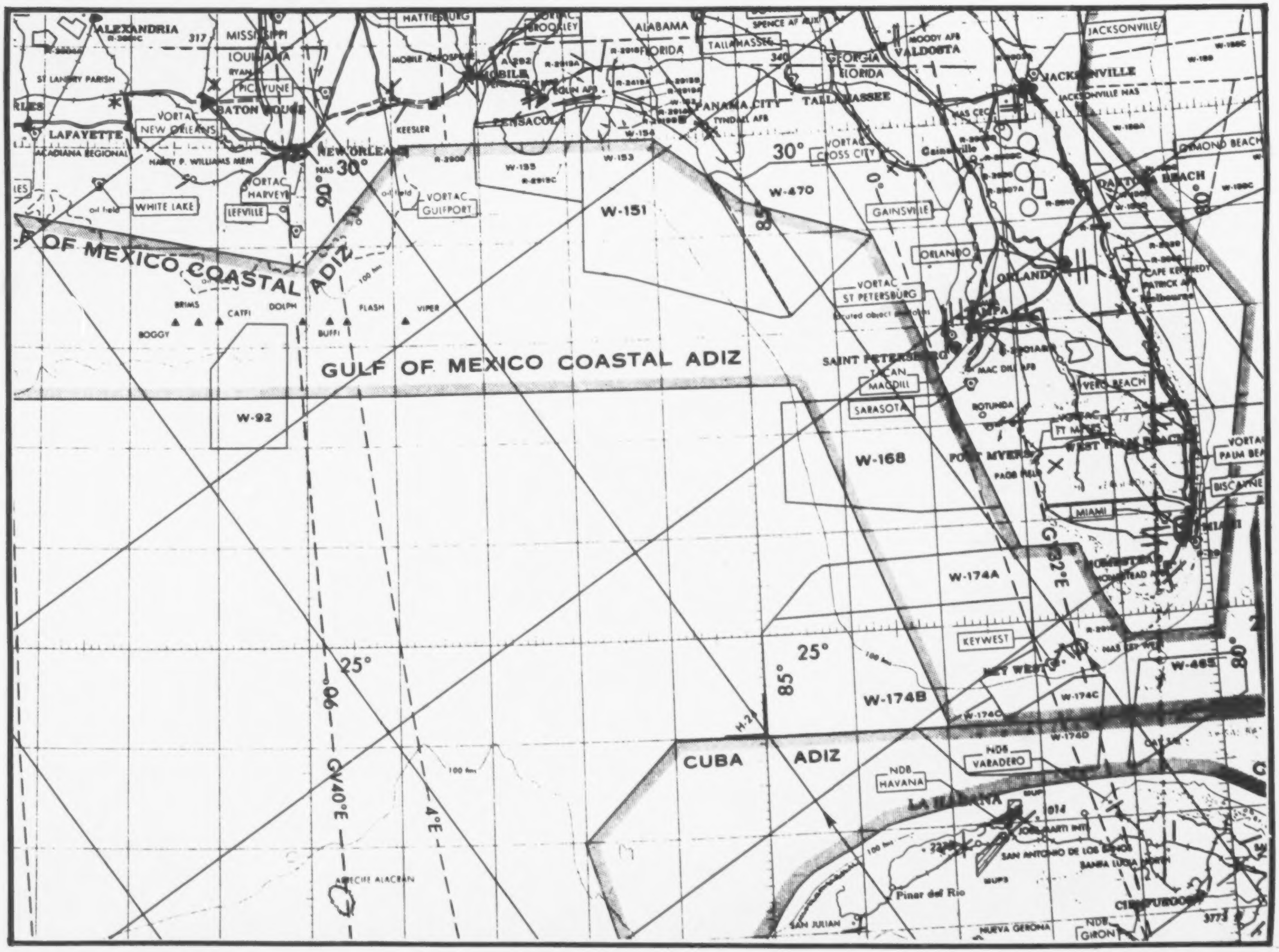

ALEXANDRIA
MISSISSIPPI
LOUISIANA
ALABAMA
FLORIDA
GEORGIA
HATTIESBURG
BROOKLEY
TALLAHASSEE
VALDOSTA
MOODY AFB
JACKSONVILLE
MOBILE
PICAYUNE
BATON ROUGE
LAFAYETTE
ST LANDRY PARISH
ACADIANA REGIONAL
VORTAC NEW ORLEANS
NEW ORLEANS
PENSACOLA
KEESLER
PANAMA CITY
TYNDALL AFB
TALLAHASSEE
VORTAC CROSS CITY
30°
GAINESVILLE
ORLANDO
DAYTONA BEACH
CAPE KENNEDY
PATRICK AFB
VORTAC HARVEY
VORTAC GULFPORT
WHITE LAKE
LEEVILLE
W-155
W-153
W-151
W-470
90°
85°
80°
GULF OF MEXICO COASTAL ADIZ
100 fms
BRIMS
CATFI
DOLPH
FLASH
VIPER
BOGGY
BUFFI
VORTAC ST PETERSBURG
SAINT PETERSBURG
TAMPA
MAC DILL AFB
TACAN MACDILL
SARASOTA
ROTUNDA
VERO BEACH
VORTAC FT MYERS
FORT MYERS
WEST PALM BEACH
VORTAC PALM BEACH
BISCAYNE
MIAMI
HOMESTEAD AFB
W-92
W-168
W-174A
W-174B
W-174C
W-174D
W-465
KEYWEST
KEY WEST
NAS KEY WEST
25°
GV 2°E
GV 40°E
4°E
H-24
CUBA ADIZ
NDB HAVANA
NDB VARADERO
LA HABANA
JOSE MARTI INTL
SAN ANTONIO DE LOS BANOS
SANTA LUCIA
Pinar del Rio
SAN JULIAN
NUEVA GERONA
NDB GIRON
CIENFUEGOS
ARRECIFE ALACRAN

FIGURE 157.—Navigation Chart.

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